# DRAFT
# ENVIRONMENTAL IMPACT STATEMENT

# 500Kv International Transmission Line NSP-TR-1

## Forbes, Minnesota to Manitoba, Canada

## Northern State Power Company



August 1978

U.S. DEPARTMENT OF ENERGY

DOE/EIS-0032-D



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# 1. SUMMARY AND CONCLUSIONS

## 1.1 INTRODUCTION

An electric utility company is required by law to obtain a Federal permit prior to the construction of a transmission line across an international border. The Economic Regulatory Administration (ERA) of the Department of Energy (DOE) is required to process the request to cross a border and to prepare an environmental impact statement on the crossing since the granting of a permit [Executive Order 10485, Part 32(A)(3)] is a Federal action. This section states that, The Federal Commission Power shall have the power to attach to the issuance of the permit and to exercise the rights granted thereunder such conditions as the public interest may, in its judgement, require."

Sections 301 and 402(f) of the Public Law 95-91, the DOE Organization Act, (Effective Oct. 1, 1977) transferred legal authority to the Secretary of Energy from the Federal Power Commission. On October 17, 1977 (Federal Register Vol. 42, No. 200) a number of utility applications which were pending were transferred to the Secretary of Energy from the Federal Energy Regulatory Commission. The DOE delegation order 02-04-5 gives authority to the Administrator of the ERA to process the application for a permit to traverse an international border with a transmission line and to ultimately grant the Federal permit required for the crossing.

A 500-kV transmission line is proposed by the Northern States Power Company (NSP) to provide a transmission facility for the exchange of electrical energy between Canada and the United States. The transmission facility would permit the sale of energy to the Northern States Power Company and Minnesota Power and Light Company (MPL) during the summer peak-demand periods and to the Manitoba Hydroelectric Board during winter peak-demand periods. The capacity for exchange would further insure the margin of reserve for NSP and the Manibota Hydroelectric Board.

The U. S. portion of the proposed line will extend a distance of approximately 200 miles (322 km) from the Forbes substation in St. Louis Co., Minnesota, to the U. S.-Canadian border approximately three miles west of Marvin Lake in Roseau County. The line will traverse 114 miles (184 km) of state-owned land, 35 miles (56 km) of county-owned land, 44 miles (70 km) of private land, 9 miles (14 km) of land owned by mining companies, and 0.9 mile (1.5 km) of federal lands. The natural plant communities along the line consist mostly of spruce-fir, aspen-birch and pine forests, various conifer-bog associations and shrub associations. The line also traverses extensive areas of poor quality swamp forests and extensive bog areas of the glacial Lake Agassiz.

## 1.2 CONSTRUCTION IMPACTS

The applicant will employ contractors to clear the right-of-way (ROW), erect towers and string the conductors. Clearing will occur in wetlands (bog areas) mainly in winter when the ground is frozen. Towers will have a minimum conductor clearance of 39 ft (12 m) and be spaced at 0.25 mile (0.4 km) intervals. Erection of 650 guyed towers and conductor stringing in winter in bog areas will minimize impacts to soils along the right-of-way. Some tower erection and conductor stringing may be required during periods when the ground has thawed resulting in localized soil compaction and minor erosion. The 150 free-standing towers will be used primarily in the drier agricultural areas. Where feasible, the towers will be placed along fence rows between fields to avoid interference with agricultural practices.

Vegetation screens will be left along the ROW at stream and highway crossings to reduce erosion and visual impacts resulting from line construction. No permanent adverse impacts to aquatic organisms inhabiting streams and wetlands along the ROW are expected from the proposed construction (see Sec. 4.4).

Terrestrial fauna will be most greatly affected by habitat losses from ROW clearing. Impacts to wildlife will mostly be related to those species dependent on forest habitat. In areas where low growing trees and shrubs occur and in agricultural areas only minimal clearing will be necessary. Clearing for access roads will also result in losses of wildlife habitat.

Some socioeconomic impacts may result from the inmigration of workers to construction areas. Increasing demands will be placed on local housing, schools, medical facilities, and other

community services, particularly in portions of Networks III and IV. If the applicant decides to allow construction contractors to establish work camps, other temporary impacts such as damage to vegetation at the camp site, soil compaction, and noise effects on wildlife will occur.

## 1.3 OPERATIONAL IMPACTS

Once construction is completed the applicant will institute a vegetation management program for the ROW. The use of herbicides will be in accord with State of Minnesota regulations. Selective cutting will be employed to remove some tall tree species and where the use of herbicides is not appropriate. No adverse impacts to nontarget species are expected as a result of the management program. The staff is of the opinion that the management program will enhance the wildlife habitat quality of certain portions of the ROW. In some areas that are presently covered by coniferous forest species low growing shrubs and deciduous successional species will become established after clearing. The return to an earlier successional stage will attract various wildlife species not presently inhabiting dense forests.

Operation of the line will result in maximum audible noise of 48 dBa at the edge of the ROW during periods of foggy weather or immediately after a rain storm when the conductors are wet which produces maximum audible noise. The noise level is not expected to adversely impact residents living adjacent to the ROW but may be somewhat annoying to persons walking along the line. Electric field effects, induced voltage effects, and ozone production are not expected to adversely affect men and other biota. Some radio and TV interference may be noticed at residences along the corridor. The applicant, however, has committed to evaluating complaints on TV interference and providing residents with appropriate mitigation in the case of TV interference.

## 1.4 OVERALL FINDINGS

The staff concludes that construction and operation of the proposed 500-kV transmission line is environmentally acceptable. The benefits to be gained by NSP and MPL in purchasing electrical power from an existing power supplier (Manitoba Hydroelectric Board) are far less damaging to the environment than the construction of a new electrical power facility in Minnesota to supply added reserve capacity during peak periods. The project also benefits Canada in that power can be purchased from the applicant during the winter peak-demand periods and thus not require new generating facilities.

The staff believes that the applicant's proposed construction and operational practices have been carefully planned to minimize environmental impacts. The staff is of the opinion that adequate planning by the applicant and agencies such as the Minnesota Environmental Quality Council, the Minnesota Department of Natural Resources, and a Technical Routing Review Committee has resulted in the selection of a proposed route which will have limited adverse environmental effects on the general populace in the affected area.

Details concerning the construction and operation of the Canadian portion of the proposed transmission line to enable electrical energy exchanges between Manitoba Hydro and NSP are not incorporated in this document. However, a summary of the Manitoba Hydro environmental assessment and related certification processes is presented in Appendix B.

# 2. THE PROPOSED PROJECT

## 2.1 OBJECTIVES

A 500-kV transmission line is proposed to provide a high-capacity transmission network of mutual benefit to the Northern States Power Company (NSP), hereafter referred to as the applicant, to the Minnesota Power and Light Company (MPL) and to the Manitoba Hydroelectric Board (MH). The new transmission facility would permit the sale of electrical energy to Manitoba Hydro during winter peak-demand periods and the sale of energy to NSP and MPL during summer peak-demand periods. In addition, the capacity for exchange would further insure the margin of energy reserve NSP is required to maintain as a member of the Mid-Continent Area Power Pool (see Sec. 8.1) (ER and Ref. 1).

Manitoba Hydro's electric system receives power from hydroelectric generators. Often the company will normally have a summertime surplus of water which can be used to generate additional energy, given an accessible market. The electrical generating facilities in Minnesota are predominantly nuclear and fossil-fueled.

## 2.2 GENERAL DESCRIPTION

The proposed project consists of the construction and operation of a 500-kV single circuit transmission line traveling northwest from a substation near Forbes, Minnesota, to a point on the US-Canadian border, approximately three miles west of Marvin Lake in Roseau County.[2] The proposed route is described in Section 2.4.1 and the affected environment along the route in Section 3.

## 2.3 FEDERAL REQUIREMENTS

A Presidential Permit is required to construct, operate, maintain and connect facilities for the transmission of electrical energy at the boundary between the United States and Canada [Executive Order No. 10485, Part 32 of the regulations of the US Department of Energy (DOE), Economic Regulatory Administration) (ERA)]. Consequently ERA is required by law to prepare an environmental impact statement for the project. Although the border crossing is the only portion of the project requiring a federal permit, the entire transmission route from Forbes to the border is addressed in this document since a border interconnect with the Manitoba transmission line would not be needed in the absence of a 500-kV transmission line in Minnesota.

A 401 permit from the U.S. Army Corps of Engineers will be required for construction activities at river and stream crossings and in wetlands.

An order must be secured from the ERA pursuant to Section 202(e) of Part II of the Federal Power Act (49 stat. 849, 16 U.S.C. 824 a(e)) for the transmission of electrical energy from the United States; however, a State, a political subdivision of a State, or a public agency or officer is exempt from the requirements of Part II by virtue of Section 201(f) thereof (49 Stat. 848, 16 U.S.C. 824(f)).[2] Before it will issue an export order, the ERA must find that the proposed exportation will not impair the sufficiency of electric supply within the United States and will not impede or tend to impede the coordination in the public interest of facilities subject to DOE jurisdiction. Electric energy may be transmitted from a foreign country to the United States without Federal authorization.[2]

## 2.4 THE PROPOSED TRANSMISSION LINE

### 2.4.1 Proposed Route

#### 2.4.1.1 Route Selection Process

The goals of route selection are to minimize impacts on biota, landscape features, structures, and pre-existing activities, while successfully accomplishing the task. A detailed description of classes of environmental concerns regarding route selection are described in Table 3.1-1 of the applicant's Environmental Report.

The first action by the applicant was to identify potential impacts by making an extensive inventory of environmental and cultural features for the entire northern Minnesota study area. Data gathering was based on criteria established by the State of Minnesota's Power Plant Siting Act, (ER, App. C) as well as by recommendations of the Technical Routing Review Committee (TRRC), an ad hoc committee of knowledgeable individuals not affiliated with NSP (ER, Table 3.1-2). The criteria essentially require that the transmission line should minimally impact the natural and artificial environmental features and uses that are to be affected by the construction of the power line.

The TRRC worked with representatives of NSP to develop the list of data to be used in studying routes (ER, Table 3.1-3). To facilitate the processing of information, data were gathered and computerized for each 40-acre (16-ha) parcel of the study area. All man-made and natural features (e.g., streams, ditches, urban areas, highways, recreational areas, etc.) found in each parcel were listed; miles of route through the parcel and an importance factor assigned to each item were used to weight the judgement (ER, Table 3.1-3). All information was then submitted to computer analysis.

The TRRC then recommended that the highest constraint classes that had conspicuously adverse long- and short-term effects on the environment or transmission line design or economics be combined to form a composite constraint map (ER, Figs. 3.3-6 and 3.3-6a). NSP then developed a network of links and nodes incorporating the following requirements:

1. All links in the network must avoid major constraint areas on the composite map wherever possible.

2. Access required for construction and maintenance must be available.

3. From land-use and environmental standpoints, discrete alternative routes must exist within the network. In other words, the network must supply decision makers with clear alternatives in choosing the proper balance of impacts on the land.

The weighted constraints or impacts along each of the possible routes were accumulated to create an environmental index for each of the major concerns. In this manner the identified routes were compared and the relative impacts (summarized in Chap. 4, ER) were determined.

As part of Minnesota's regulatory process a committee of citizens from northern Minnesota was established to review the routing alternatives and make a routing recommendation to the Minnesota Environmental Quality Council (EQC). The committee met regularly for four months, studied the routing network, made a few adjustments, and ultimately decided on a route for recommendation to the EQC.

Finally, twelve public hearings were held for the purpose of receiving information and opinion from the applicant, the citizens' committee, all interested state agencies, and the public regarding the routing of the 500-kV transmission line.

After seven months of study the Minnesota Environmental Quality Council met to decide the best route for the 500-kV transmission line. The designated route was chosen based on the application, the state's environmental impact statement, the data, including aerial photography, the recommendation of the citizens' committee, and findings of an independent hearing examiner.

#### 2.4.1.2 The Designated Route

The route designated by Minnesota Environmental Quality Council is approximately 200 miles (320 km) long and extends from the Forbes substation southeast of Hibbing to the International border west of Warroad (Fig. 2.1). Throughout both the descriptive and impact sections of this statement the route will be addressed in terms of the four networks shown in Figure 2.1.

Network 1 is 45 miles (72 km) long. The route leaves the Forbes substation to the west, paralleling two 115-kV transmission lines for three miles (4.8 km), turns north, crosses County Highway 16, and parallels an existing 230-kV transmission line for almost five miles (8 km). Just north of McQuade Lake the 500-kV line will leave the 230-kV line and parallel the iron formation. The mining area is then crossed at a right angle along Minnesota State Highway 169 and County Highway 5, just west of the city of Chisholm. The designated route again parallels an existing 230-kV transmission line to a point three miles (4.8 km) southeast of Mirror Lake in Itasca Co., where Network 2 begins. This area is forested with a few small open bogs. Network 2 is 86 miles (138 km) long. The 500-kV line will then continue to the northwest through boggy country. Part of the route is through the boglands of Pine Island State Forest for 17 miles (27 km) and again turns to the northwest across an area of roadless bog. Network 3 is 34 miles (55 km) long. It proceeds northwest through Lake of the Woods County, across a mixed landscape of aspen forest, wet lowland bogs, a few open meadows, and through the Beltrami Island State

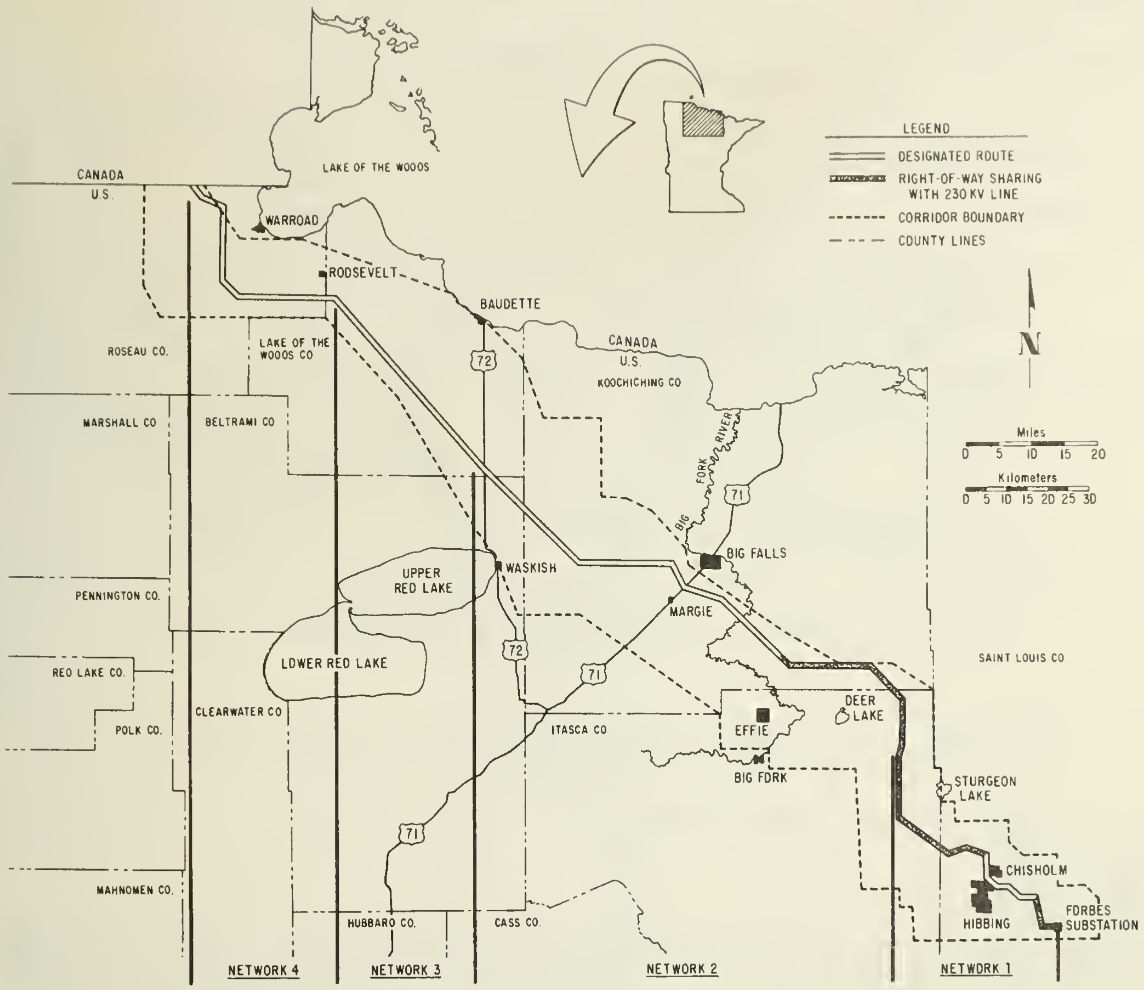


Fig. 2.1. Designated Route of the Proposed 500-kV Transmission Line.

Forest. Network 4 is 34 miles (55 km) long. It starts in Beltrami Island State Forest and runs northwest to a point five miles (8 km) south of Warroad where it parallels a 230-kV line to the International Border.

The designated International Border crossing is approximately 7-1/2 miles (12 km) west of where U. S. 313 ends at a port of entry.

### 2.4.2 Design Parameters

Design Summary

1) Voltage Level
   a) Nominal operating: 500 kV ac
   b) Maximum operating: 550 kV ac

2) Conductor: Three-conductor bundle of "BUNTING"

   954 kcmil ACSR 54/7
   (1.196-inch diameter) (3.038 cm) per phase.

3) Structures
   a) Self-supporting steel structures
   b) Guyed aluminum structures

4) Ground Clearance: 35 feet (11 m) minimum at 200°F (93°C)

   conductor temperature. [NESC requirement for a 500-kV line is 31 ft (9.4 m) minimum at 200°F (93°C).]

5) Right-of-Way
   a) 160 feet (48.8 m) when adjacent to an existing 230-kV right-of-way.
   b) 200 feet (61 m) wide when on a new, independent right-of-way.

6) Length: 200 miles (320 km) (approximately).

#### 2.4.2.1 Tower Design

The 500-kV structures will be of two different structural configurations. The first type will be a self-supporting steel lattice structure, shown in Figure 2.2. The steel lattice structure will be four-legged, and will require no external means of support. The second type will be a guyed aluminum lattice structure, shown in Figure 2.3. The guyed aluminum structure will have a single vertical column and will require four guy wires and earth anchors to obtain the same structural stability as the steel lattice structure.

All structures in the 500-kV line will be designed to meet the strength requirements for the Heavy Loading District, as designed by the National Electrical Safety Code (NESC). In addition, the following loadings in excess of NESC requirements will be incorporated in the structure designs:

- an 80 mile-per-hour (35.8 m/s) ground-level wind on the bare cables and structure

- a longitudinal load resulting from one broken conductor, or one-inch (2.54 cm) differential ice loading on one three-conductor bundle

- a longitudinal load resulting from one-inch differential ice loading on either of the shield wires

- a vertical load resulting from one-inch radial ice on all conductors and shield wires with no wind.

For each structure type, a series of angle and dead end structure designs will be prepared in addition to the tangent design. The loadings for these structure designs will be in accordance with NESC requirements, which call for a 4 psf (40-mph) (17.9-m/s) wind on the structures and conductors with a one-half inch (1.27-cm) coating of radial ice. In addition, the angle structures must be designed to withstand the loads resulting from the transverse component of the tension of the conductors and shield wires due to change in direction of the line. The dead end structures must be designed for both of the loading conditions for angle structures, plus the loads resulting from the in-line tension of the conductors and shield wires.

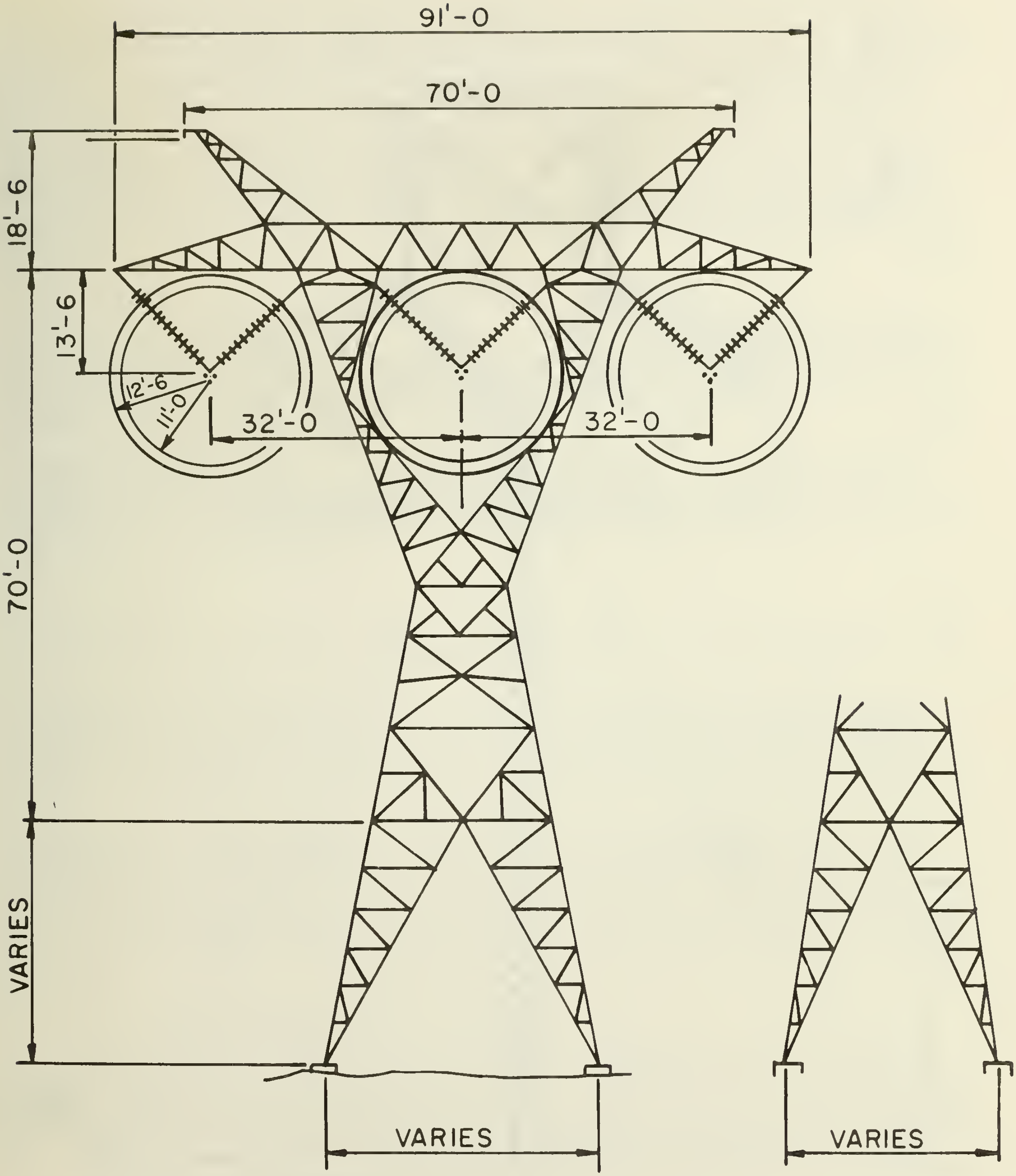


Fig. 2.2. Self-Supporting Steel Structure.

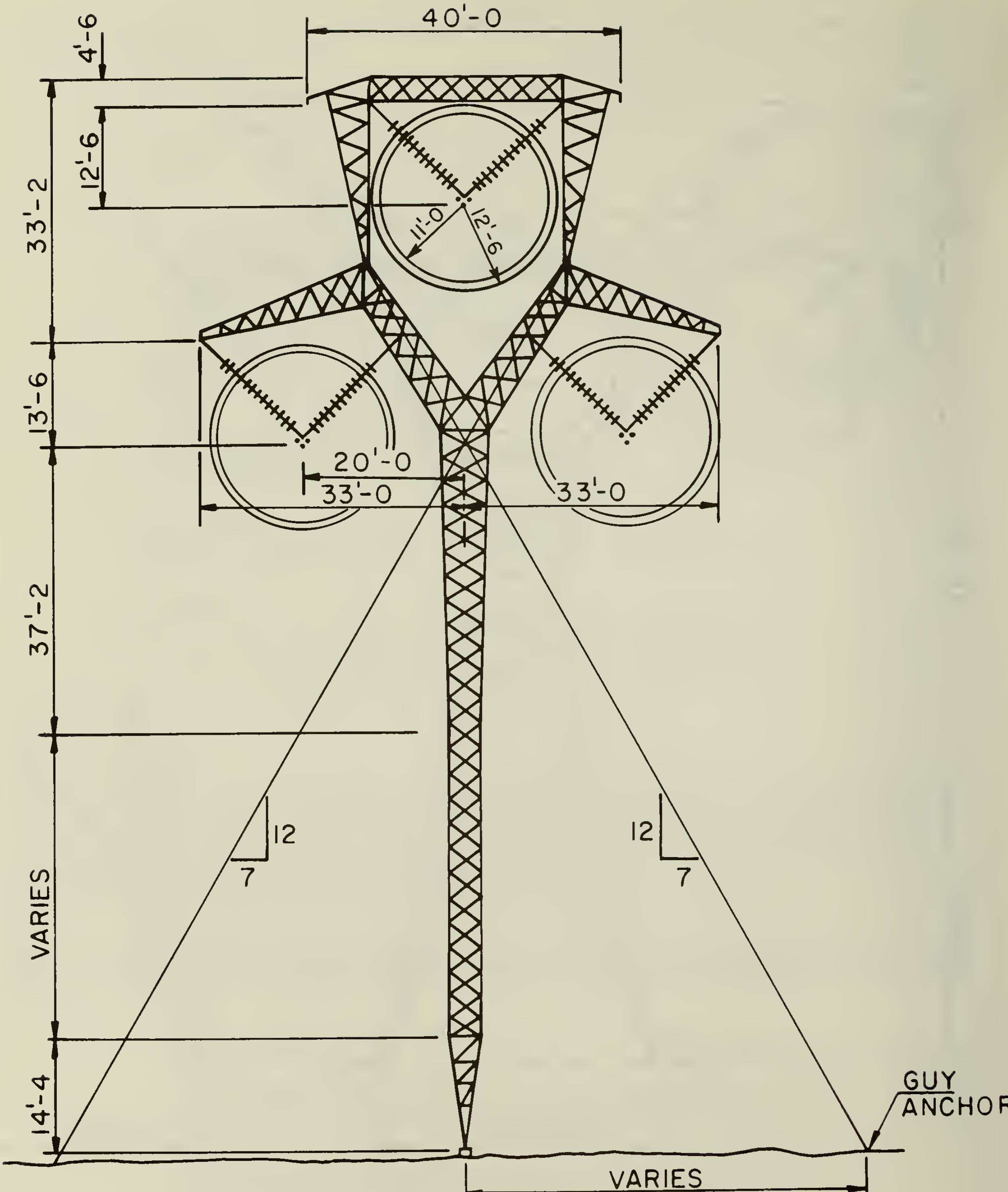


Fig. 2.3. Guyed Aluminum Structure.

The basic foundation for the self-supporting structure will be reinforced concrete drilled shafts shown in Figure 2.4. This foundation consists of an augered hole filled with concrete reinforced with steel, with a stub angle installed for attachment of the structure. The diameter and depth of the drilled shafts will vary, depending upon soil conditions at the structure locations. Alternate towers (Fig. 2.3) and foundation types (Fig. 2.5) will be utilized at major angle points and at structure locations that exhibit poor soil conditions.

The foundation for the guyed aluminum structure will be a "foundation anchor" shown in Figure 2.5. This foundation will consist of a tripod arrangement of large helix screw anchors with steel pipe extensions. A fabricated steel assembly will connect the three steel pipes at the ground line to support the structure base. Four helix screw anchors for the guy wires will also be installed around the foundation anchor. No excavation will be required for this foundation installation.

#### 2.4.2.2 Conductor Design

Each of the three phases of the 500-kV line will consist of a triangular, three-conductor bundle with 18-inch conductor spacing, as shown in Figure 2.6. The conductor for the 500-kV portion of the EHV transmission line will be 954,000-circular-mil aluminum conductor steel-reinforced (ACSR) with seven steel core strands and 54 outer aluminum strands. The conductor has an overall diameter of 1.196 inches (3.04 cm).

Two shield wires will be installed on the structures to provide protection from lightning strokes to the conductors. The shield wires will consist of seven No. 7 AWG (American wire gauge) aluminum-clad steel cables with a diameter of 0.432 inch (1.097 cm). The phase-to-ground clearance is 12.5 feet (3.8 m), whereas the NESC requirement for 550-kV (10% overvoltage) is 11 feet (3.4 m) (Figs. 2.2 and 2.3).

#### 2.4.2.3 Line Design

The line design of the 500-kV line includes the selection of structure type and structure locations, determination of structure heights and preparation of construction drawings.

The selection of tower structure types will be based on the predominant land use in the area traversed by the line. In general the guyed aluminum structure will not be used in areas of intense agricultural activity. In these areas the self-supporting steel structures will be utilized. The selection of structure types will be made on a general basis for a major section of line. Structure types will generally not be mixed within a section of line.

A minimum clearance of 35 feet (11 m) between the ground and conductors at 200°F (93°C) conductor temperature will be maintained in the design of the line. Distances between structures will range from 1200 to 1400 feet (366-427 m) due to physical constraints and topography, with one-quarter mile (400-m) spans being a desired average. In flat terrain without physical constraints, a 1320-foot (400-m) span would result in an overall structure height for the self-supporting steel structure and guyed aluminum structure of 125 feet (38.1 m) and 150 feet (45.7 m), respectively. Structure heights throughout the line will vary, depending upon topography and other constraints.

#### 2.4.2.4 Right-of-Way Requirements

Two different right-of-way (ROW) requirements exist on the designated route. In the area where the existing 230-kV transmission line can be paralleled, right-of-way requirements are reduced by right-of-way sharing. One hundred and sixty feet (48.8 m) of additional right-of-way would be required adjacent to the existing 130-foot (39.6-m) right-of-way. In areas where right-of-way sharing is not possible 200 feet (61 m) of right-of-way will be required.

#### 2.4.2.5 Substation Accommodations

No switchyard or substation sites will be developed specifically for the proposed project. Within the United States, interchanges of electrical energy between the applicant and Manitoba Hydro will be affected at the Forbes, Minnesota, substation, which is owned solely by the Minnesota Power and Light Company (MP&L).[3]

Until recently, a 230-kV substation at Forbes has been MP&L's major bulk transmission transfer point for supplying energy to the eastern half of the Minnesota Iron Range. However, in view of contemporary and projected future increases in energy requirements in the service area, MP&L filed an application with the State of Minnesota for a construction permit (MEQB Docket No. MP&L TR-1A, Revised Jan. 1977) that included a request to expand the Forbes substation (ER Supp. Resp.

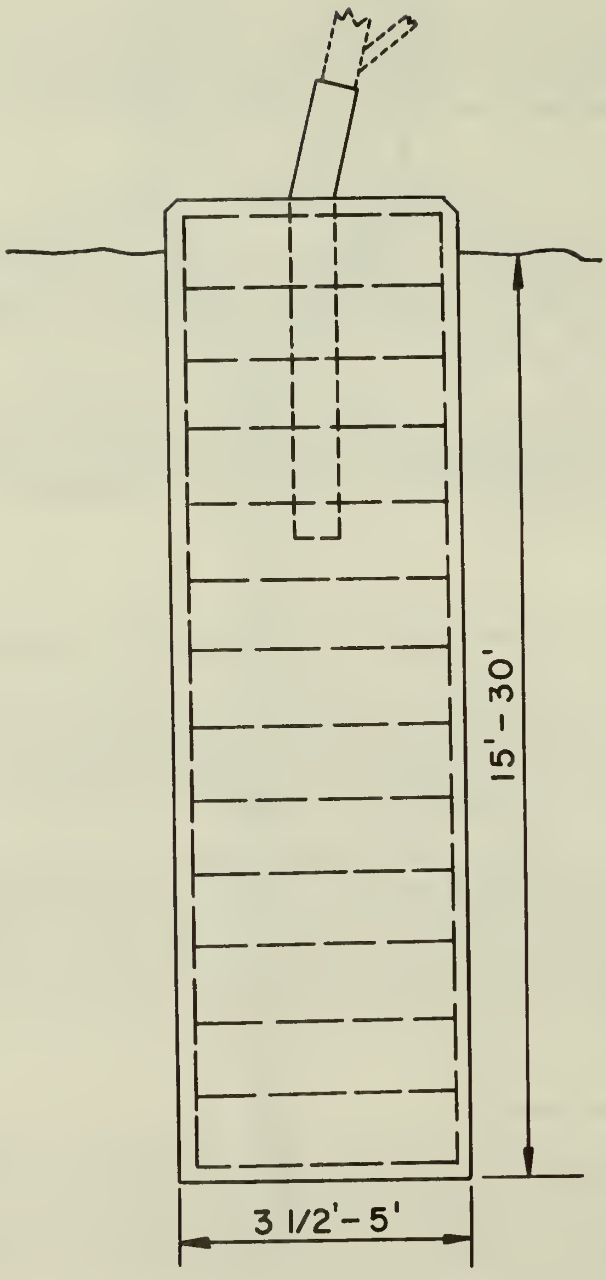


Fig. 2.4. Drilled Shaft Foundation for Steel Lattice Structure.

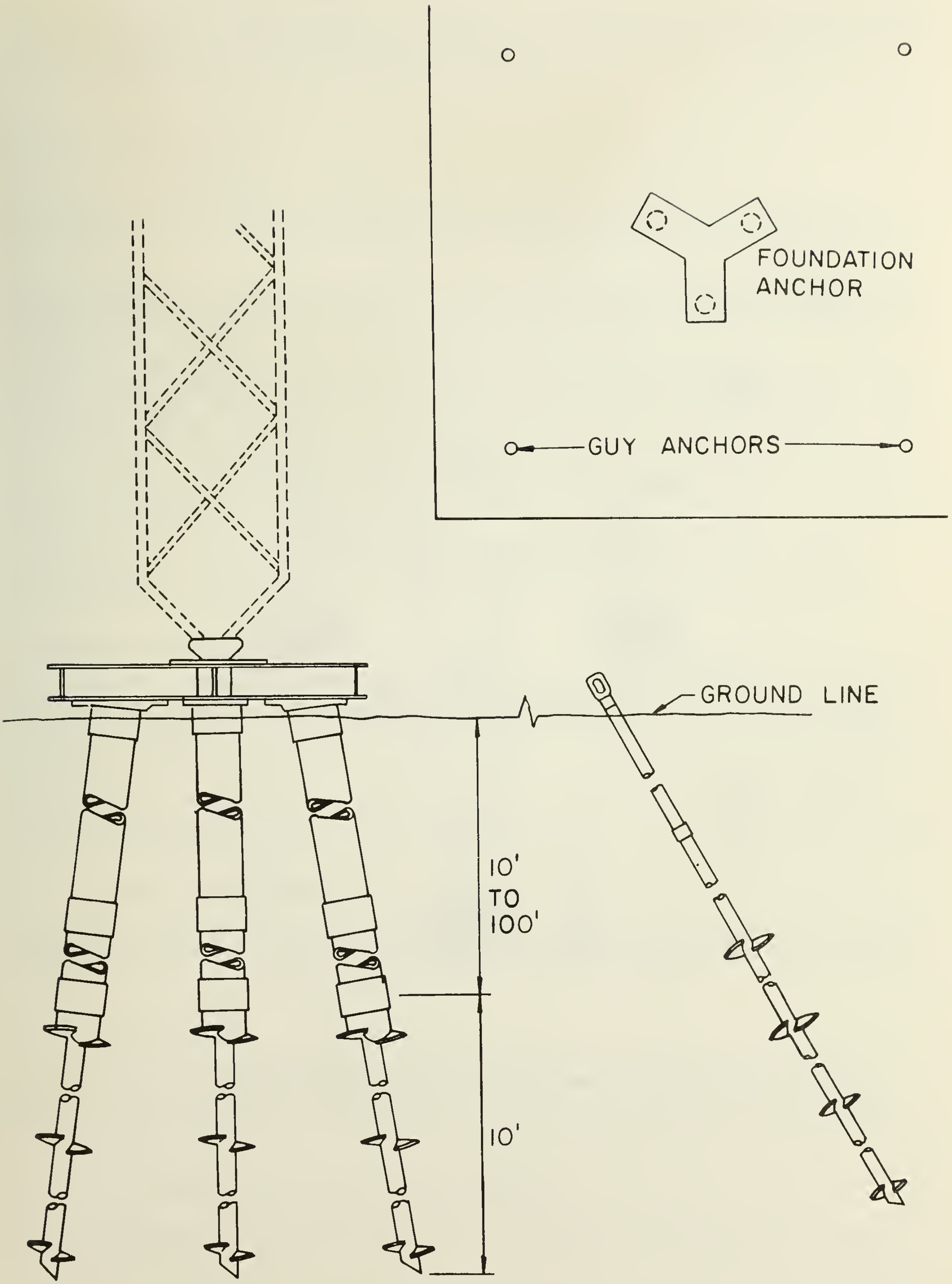


Fig. 2.5. Foundation Anchor Assembly for the Guyed Aluminum Structure.

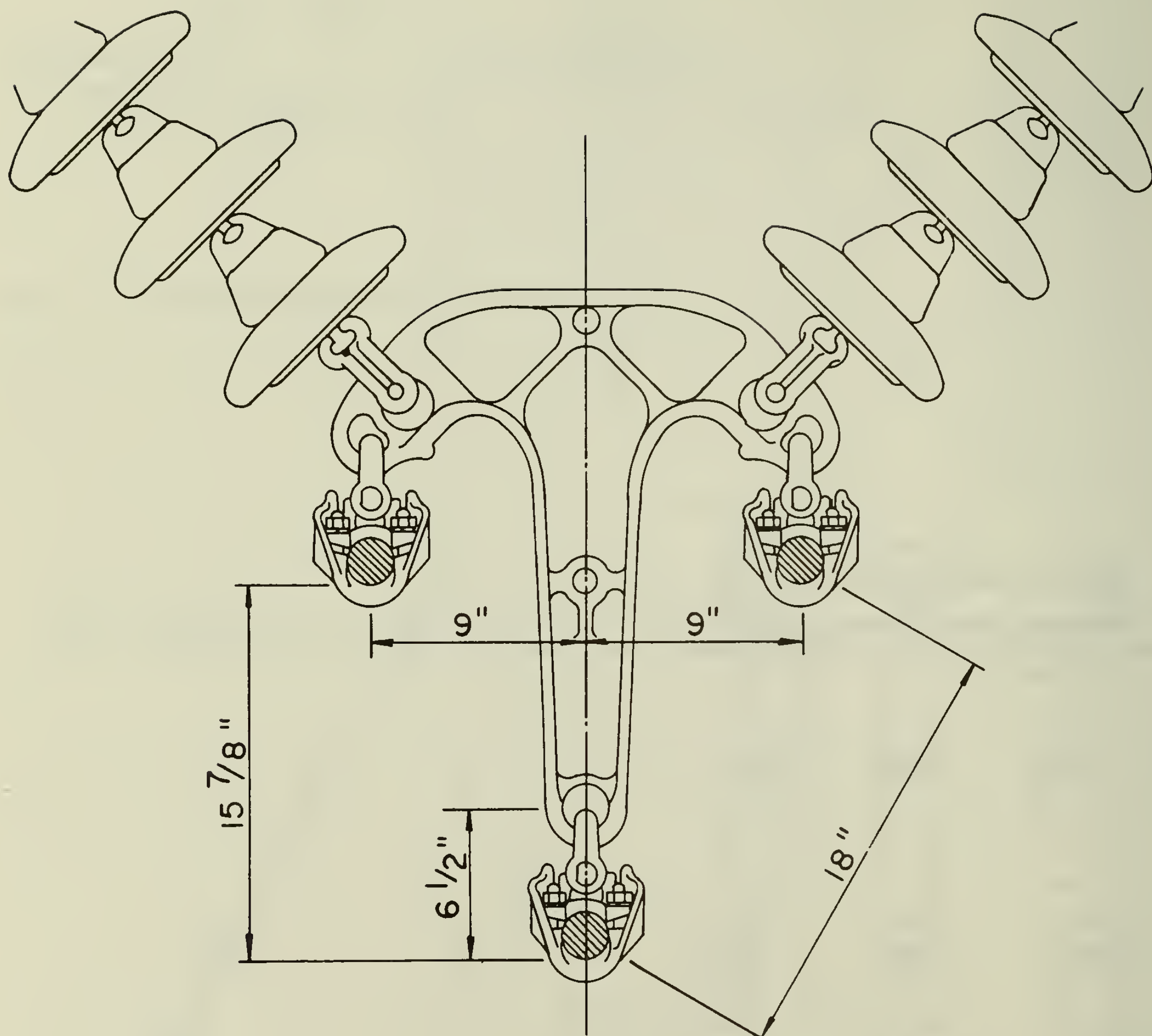


Fig. 2.6. Triangular Three-Conductor Bundle Assembly.

to Q. 31). The expansion was designed and constructed to accommodate six 500-kV exits for transmission lines and transformation.[3] While MP&L will continue to own the entire site, certain electrical equipment associated with the applicant's Forbes-to-International Border line will be installed within the substation. The principal equipment items include two 500/230-kV transformers, one 500-kV circuit breaker, and six shunt reactors.

## 2.5 CONSTRUCTION OF THE LINE

### 2.5.1 Right-of-Way Clearing

Clearing of the right-of-way is necessary to provide required clearances from the conductor, to eliminate possible hazards to the line from falling trees, as well as to facilitate construction operations.

The width of the right-of-way to be cleared for the project will vary with the line voltage and the opportunities for right-of-way sharing. On the 500-kV line where a 200-foot right-of-way is required, 180 feet (55 m) will be cleared. Where the line parallels the existing 230-kV line a 160-foot (49 m) right-of-way and 150-foot (46 m) clearing are required.

In general, the right-of-way will be clear-cut to the widths mentioned above. Tall or dangerous trees outside the cleared right-of-way which present a potential hazard to the line will also be removed, i.e., trees over 60 feet (18 m) high which lean towards the power lines or which appear to be diseased will be removed.

Where the right-of-way goes through areas of low-growing brush, deep ravines, muskeg swamps and black spruce bogs, the right-of-way clearing will normally be reduced in width to approximately the center one-third.

In some areas, such as at major road and stream crossings, selective cutting will be used. These areas will be designated by the company and selective cutting requirements made part of clearing contracts. Appendix B, ER, describes the specifications for right-of-way clearing that will be followed.

All towers will be grounded so as to achieve a maximum resistance of 20 ohms.

Steel towers will be grounded by attachment of one 6/0 copper wire to each of the four legs and attaching these wires to a driven ground rod. In areas of boulders or high bedrock, a system of counterpoise, consisting of copper wires buried 18 inches below the surface of the ground in a radiating pattern from the tower to a length required to achieve the desired resistance level, will be used.

Aluminum towers will be grounded by bonding the aluminum structure to the steel grillages and screw anchor foundations with a 6/0 copper wire. Due to the amount of metal involved in the screw anchors no additional ground rods will be required.[4]

#### 2.5.1.1 Seasonal Aspects of Vegetation Clearing Process

Clearing will be carried on throughout the year in order to meet the deadlines. Bog areas will be cleared in the winter as soon as the ground has frozen enough to support the weight of heavy equipment.

#### 2.5.1.2 Clearing Methods

All trees and brush shall be cut with a saw or other device to eliminate pointed spikes. No stumps or stubble shall be left standing higher than three inches (7.6 cm) above ground for trees with trunk diameters of 12 inches (30 cm) and under and six inches (15 cm) above ground for trees with trunk diameters of 12 inches and over. (Stump height measured on high side of sloping terrain).

Clearing will be permitted by mechanical operation unless otherwise specified. Generally, clearing will be restricted to slopes less than 15 degrees.

After any mechanical operation the contractor shall, as nearly as possible, restore the natural contour existing prior to the start of work.

2.5.1.3 Disposal of Cleared Vegetation

As specified by the company, all trees, brush and other debris shall be disposed of in accordance with the procedures outlined in Appendix A, ER. Under no circumstances will windrowing be permitted on or off the right-of-way. The following practices will be carried out in the disposal of cleared vegetation:

1) Slash to be burned shall be piled within the cleared areas such that damage to adjacent trees or other vegetation will not occur.

2) Slash will be lopped, chipped and scattered in the appropriate areas.

3) In some swamp areas, slash will be placed perpendicular to the right-of-way and packed down to a maximum height of 30 inches (76 cm).

4) All salvageable timber will be placed along the edge of the right-of-way, trimmed flush to the trunk, and piled neatly in lengths as specified by the company.

5) USEPA-Minnesota approved herbicides will be applied to the stumps and the root collar area.

## 2.5.2 Access Roads and Bridges

2.5.2.1 Access Roads

In areas where selective cutting is to be accomplished, access roads will be laid out at an angle to avoid a vista down the right-of-way. All access roads will be routed to reduce destruction of desirable plants and damage to cultivated fields. Cross-drainage will be provided and monthly aerial observations will be made to determine its adequacy.

2.5.2.2 Bridges

The Minnesota Environmental Quality Council (EQC) requires that existing bridge crossings are to be used to the extent possible for line and construction equipment crossings, holding fording to a minimum.[5] Construction in wetlands and across streams will be carried out in the winter. Snow bridges will be used to cross many streams, but Bailey bridges and culverts will be used where necessary. Erosion control measures will be used. A detailed description of bridging techniques and erosion control measures is given in Section 4.4.1.3.

## 2.5.3 Tower Installation

2.5.3.1 Tower Foundation System

Following the clearing of the right-of-way, the foundations for the structures will be installed. The foundations will be of two basic types, reinforced concrete drilled shafts and foundation anchors.

The reinforced concrete drilled shafts will be dug using a truck or crane-mounted drilling rig capable of augering holes three to eight feet (0.9-2.4 m) in diameter. During the drilling, the hole will be kept open by means of either temporary steel casing or a bentonite slurry. When the hole has been drilled to design depth, the reinforcing steel will be placed, and ready-mix trucks will deliver concrete to the site for placement. The 15 to 40 cubic yards (11-30 $m^3$) of soil excavated for each structure site will be leveled evenly around the site or, if necessary, hauled away for disposal.

The foundation anchors for the guyed aluminum structures will require no excavation or placement of concrete, which greatly reduces the amount of equipment required for installation. The foundation anchors will be installed by use of a rubber-tired or track-mounted vehicle equipped with a hydraulic operated rotary motor. The pipe portion of the foundation anchors will be installed in 10-foot (3-m) lengths to the depths required to develop a specified torque.

2.5.3.2 Tower Erection Procedure

Erection of the assembled structures will be accomplished by the use of a helicopter that will lift the assembled tower in a sling and fly the structure to the site of erection. The helicopter will hover over the site as a member of the ground crew directs the pilot in settling the base of the structure on the foundation. The four guy wires will then be temporarily tied off to the guy anchors, allowing the helicopter pilot to release the structure by activating an electrically

operated mechanism in the sling. The helicopter will then return to the marshalling yard to pick up another structure while the ground crew moves to the next site. Another crew will then follow to plumb the structure and make the permanent guy wire attachments to the anchors. Transportation of the crews to the structure sites will be accomplished by truck, all-terrain vehicle, or if necessary, by helicopter.

Internally guyed aluminum structures can be constructed by either of the above methods. The method used will be decided on when construction begins, that decision being based mainly on economics.

### 2.5.4 Conductor Stringing

The stringing and sagging of the shield wires and conductors is a multifaceted activity. During a stringing operation 40 to 50 men and a large amount of specialized equipment will be required. A normal stringing operation will entail stringing two to four miles of line in one set-up of equipment, and will require one to three weeks to complete.

Prior to the stringing operation, stringing dollies, which are neoprene lined sheaves, must be hung on each structure along with the required insulator assemblies. During this same period, "guard poles" (temporary structures consisting of two wooden poles with a crossarm between them) are placed at all locations where the transmission line crosses roads, railroads or existing overhead facilities. Lead lines of polypropylene rope are then installed between the structures in the section to be strung and are placed in the stringing dollies. At one end of the operation, the tugger, mounted on a truck or semitrailer, is moved into position. The tugger consists of a series of motor-driven drums and reels that pulls the conductors into position. At the other end of the set-up, the tensioner, also mounted on a truck or semitrailer, is moved into position along with the conductor trailers, reel strands and reels of conductor. The tensioner consists of two motor-driven wheels per conductor that provide braking action during the stringing operation to prevent the conductor from touching the ground, and to facilitate pulling the conductor up to proper sag.

Before the conductors are strung, steel cables and shield wires are attached to the polypropylene lead lines and the tugger reels up the lead line pulling the steel cable and shield wires into position. Temporary anchors are used to secure them until the set-up is completed. The conductors are then strung, one phase at a time, which results in either two or three conductors being strung in one operation. When all conductors and shield wires have been pulled into position, they are pulled up to the proper sag and final attachments are made at each structure.

The construction activities discussed will be performed sequentially. It will take many months to complete all construction activities in any one section of line. Activities will not be continuous but will occur periodically as different crews move from site to site.

### 2.5.5 Environmental Controls and Impact Mitigation Measures

Where the entire width of the right-of-way traverses vegetation types such as low growing brush, muskeg swamps or black spruce bogs, or when the right-of-way crosses a deep valley or ravine, the clearing shall be reduced in width to approximately the center one-third of the right-of-way. Also, where selective cutting may be beneficial, this type of clearing will be accomplished as designated by the company. In areas where the company has purchased timber rights, efforts shall be made to salvage as much merchantable wood as possible, provided it is economically feasible.

#### 2.5.5.1 Timing of Clearing

Where the ROW crosses wet areas, clearing will begin after the ground has frozen and will be carried on as long as the hard freeze lasts. In other areas clearing will be carried on throughout the year.

#### 2.5.5.2 Selective Clearing

Selective cutting will be performed in areas of high public exposure, including interstate and U.S. highways, heavily traveled state and county roads, streams and lakes, and other environmentally sensitive areas, such that a natural vegetative screen remains. Trees and shrubs designated as screens shall be marked or otherwise noted by the applicant prior to commencement of clearing.

If natural vegetation is such that a screen cannot be left and suitable natural revegetation does not occur within two years following clearing, planting of native types of shrubs and low

and/or slow growing trees to provide adequate screening shall be considered by the applicant. A list of native plant species which should be selected for these areas is shown in the ER, Table 1, Appendix A.

#### 2.5.5.3 Debris Removal

Clean-up and restoration of the right-of-way will be the final activity and will entail moving excess materials and general construction debris as well as repairing damages done to the right-of-way. Damage settlements will then be secured from the individual property owners. Detailed state requirements regarding ROW clearing and debris removal are included in State of Minnesota Environmental Quality Council Findings of Fact and Construction Permit.[5]

#### 2.5.5.4 Erosion Control

Where the ground surface is severely disturbed, "seeding with a mixture of grasses and clover shall be considered" (ER, App. A, p. A-9).

To minimize impacts where aquatic systems and surface hydrology are concerned, necessary fording operations will be coordinated with the local Minnesota Department of Natural Resources (MDNR) managers and their recommendations will be followed. Where the situation dictates, seeding of desirable grass-clover mixtures on both sides of a water crossing will be accomplished.

Surface runoff will be controlled by selective cutting within an appropriate distance from the water's edge. In employing selective cutting, as much riparian vegetation will be left as possible.

## 2.6 OPERATION AND MAINTENANCE OF THE LINE

### 2.6.1 Operational Characteristics

The following discussion is limited to operational characteristics that influence the environment or the use of the area within and adjacent to the transmission line right-of-way (ROW). Engineering aspects of operation will be treated only as necessary to the discussion.

#### 2.6.1.1 Corona Phenomena

Corona entails localized electrical discharge when the electric field at the energized conductor surface exceeds the dielectric of the surrounding air. The occurrence of corona results in energy loss. Transmission lines are designed such that corona discharges are generally negligible during fair weather. Discharges are enhanced by imperfections in conductor surfaces, airborne dust, rainfall, and water droplets that accumulate on conductors during foul weather. The notable effects associated with corona discharge are described in the following sections.

##### Audible Noise

The general audible noise levels associated with overhead transmission lines are highest during heavy rainfall. However, since the sound of raindrop splash contributes to high ambient noise levels and thereby masks the sound produced by the line, the crackling (hissing) and low frequency humming sounds associated with high voltage transmission are more discernible immediately following rainfall or during foggy weather. Wet-conductor noise levels generated by standard design 500-kV transmission lines are primarily sources of annoyance rather than an environmental hazard.[6]

According to the applicant, the nominal and maximum operational level of the proposed transmission line will be at 500 and 550 kV (alternating current) respectively. Design standards are such that nominal operation will result in noise levels of about 52 dB (wet-conductor conditions) at the centerline, and 48 dB at the edges of the transmission line ROW (ER, Fig. 2.1-0). Corresponding values for maximum transmission voltage are about 58 and 55 dB, respectively. Such sound levels are comparable to, or intermediate between those of a typical business office and the living room of a suburban home. Since corona discharge is negligible during fair weather, audible noise levels will be correspondingly low. However, the applicant is required to comply with Minnesota Noise Standards (WPC-2),[5] which are based on "Noise Area Classification" ratings and provide for differentiating between daytime and nighttime noise levels.[7]

Radio Interference

The electromagnetic fields generated by corona discharges are potential sources of "radio noise," a general term that refers to any adverse disturbance within the radio-frequency band which ranges from 3 kilohertz (kHz) to 30,000 megahertz (MHz). The radio noise that degrades radio reception is referred to as radio interference (RI).[8] The effects of corona-induced noise are primarily limited to the 0.5 to 1.5 MHz frequency band; thus the RI effects on AM broadcast signals are relatively severe while short wave and FM signals, operative at higher frequencies (88 to 108 MHz), are not generally affected.[9]

Tennessee Valley Authority personnel, using quasi-peak detectors to measure noise near the 1.0-MHz frequency, have reported an average reading of 40 dB (above 1.0 μV/m, hereafter inferred) at a 50-foot lateral distance from a point directly beneath the outer phase of 500-kV lines.[10] The range of readings during fair weather was about 30 to 47 dB. Typical RI levels at 300 or more feet from the lines were about 20 dB, approximately ambient background noise levels. Reported RI levels for 550-kV single-circuit base-case geometries [1.19-inch-diameter subconductors (3)] are about 74 and 70 dB (at 50-foot lateral distance from the outside conductor) for heavy rain and wet-conductor conditions, respectively.[8] Byron has reported the expected EHV transmission-noise levels in the 88 to 108 MHz FM band are 18 to 24 dB at the edge of the transmission ROW during foul weather, levels essentially indistinguishable from ambient background noise.[11]

Television Interference

Corona-induced radio noise that degrades television broadcast signals is referred to as television interference (TVI) Three frequency bands are used for television broadcasting--the 54-88 MHz band (VHF Channels 2-6), the 174-216 MHz band (VHF Channels 7-13), and the 470-890 MHz band (UHF Channels 14-83).[11] Since TVI decreases with increasing frequency, operational characteristics of the proposed 500-kV line will be variable with respect to the generation of TVI, Channels 2 through 6 being most sensitive to corona discharge.

Barthold et al. state that theoretical methods for predicting TVI are not currently available (1976).[9] However, the known relationships between frequency and RI can be used as a basis for estimating TVI. For 500-kV lines of single-circuit, base-case geometry with three 1.19-inch-diameter subconductors, the estimated TVI is about 74 dB for the 83-MHz frequency (Channel 6). The reading is applicable during heavy rainfall (worst case) at a 50-foot lateral distance from the outside phase.[8] A comparable TVI for the 54-60 MHz (Channel 2) band is about 79 dB. In view of the relationship between TVI and RI, the former may be expected to decrease with increasing lateral distance from the line similar to that for RI previously noted.

Gaseous Effluents

Theoretically, the occurrence of corona discharge results in production of gaseous effluents including ozone and oxides of nitrogen. However, various laboratory studies indicate that outdoor transmission lines are extremely inefficient as generators of gaseous effluents and that the probability of measuring incremental ground-level concentrations is essentially zero.[11] Results of extensive field measurements involving 750-kV transmission lines are consistent with the laboratory studies, as are the conclusions derived from the New York Public Service Commission Hearings (Cases 26529 and 26559).[12] Thus the production of gaseous emissions resulting from corona discharge is not considered a significant operational characteristic of the proposed 500-kV transmission line.

Related Conductor Surface Discharge

In addition to corona, discharge from energized conductors may result from poor connections and loose or defective hardware. Such "gap-type" or "sparking" discharge contributes to the aforementioned effects resulting from the occurrence of corona. The conditions whereby corona discharge is enhanced also contribute to increased sparking discharge. However, sparking discharge can be minimized by normal line maintenance methods, thus reducing transmission energy losses.

2.6.1.2 Conduction Potential

When energized, the conduction current of the proposed line will vary with the desired operational level of the system, but whenever the lines are energized natural or inadvertent fault currents may occur.

Direct Contact

The minimum clearance between conductor lines and ground surface will be 35 feet (11 m) at 200°F (93°C). Thus the probability of a grounded conductive object coming into direct contact with an energized line and creating a ground fault current is relatively remote.

Ground Potential

If uncontrolled, line-to-ground fault conditions result in the development of strong ground currents with corresponding voltage potentials. However, the proposed system employs high-speed relay mechanisms to remove faulted circuits from service (ER, Sec. 2.1.2.2).

2.6.1.3 Induction Potential

Energized overhead transmission lines cause three primary electromagnetic fields: both vertical and horizontal electric fields and a general magnetic field. Thus both electrostatic and electromagnetic induction potentials occur (see Sec. 4.4.2.2).

Electrostatic Fields

Electrostatic induction is a function of voltage gradient that decreases rapidly with increasing distance from the energized conductors. Thus any conductive object located within the transmission ROW may become charged (induced voltage) depending upon the size of the object, proximity to the phase conductor, and the degree to which the object is insulated from the ground. Contact between the charged object and the ground results in "short-circuit currents" (ER, Sec. 2.1.2.4). The proposed line will be designed such that the short-circuit current will not exceed 3.5 milliamperes when the largest anticipated kind of agricultural equipment is located within or near the portion of the ROW where ground-to-conductor clearance is minimal.[13] The National Electrical Safety Code standard for comparable conditions is five milliamperes.[14] The spark energy (capacitative discharge) associated with a five-milliampere current is expected to be 100 millijoules (ER, Sec. 2.1.2.4.2).

The maximum ground-level voltage gradient will be about 6.9 kV/m beneath the outside 500-kV conductor at minimum ground-to-line clearance. At maximum operational voltage (550 kV), the corresponding voltage gradient will be 7.6 kV/m. Ground-level gradients of the horizontal 500-kV electrostatic field will be 1.6 kV/m at 100-foot, and 0.5 kV/m at 150-foot lateral distances from energized conductors at minimum clearance. At 550-kV operating levels, the corresponding gradients will be 1.7 and 0.6 kV/m, respectively (ER, Sec. 2.1.2.4.2). In instances where the proposed 500-kV line will parallel an existing 230-kV transmission line, the electrostatic field gradient will differ from those noted previously. However, the ground-level gradients common to both systems will be of low intensity because electrostatic effects are not additive or reinforcing.

Electromagnetic Fields

Whereas electrostatic fields are a function of voltage, the effects of electromagnetic fields are directly proportional to the magnitude of current flow. Thus the maximum short-circuit 5 milliampere flow alluded to in the preceding section is also relevant and results in an increase in the strength of the local electromagnetic field.

The general strength of the electromagnetic field at ground level beneath the proposed 500-kV line will be about 0.32 gauss (ER, Sec. 2.1.2.5) at minimum ground-to-line clearance. Field strength will rapidly decrease with increasing lateral distance from the line. Ground-level conductive objects, such as ungrounded fences, which parallel the proposed line will be appreciably energized due to inductive coupling.

2.6.2 Maintenance

2.6.2.1 Transmission Line

The maintenance routine for the proposed transmission facilities will include periodic surveillance and restorative maintenance. Monthly surveillance patrols will be made using fixed-wing aircraft or helicopters (ER Supp., Resp. to Q. 26). Exceptions to aerial inspections may occur in the event that "wishes of parties adversely affected by such activities" are reported, as prescribed by the Minnesota Environmental Quality Council (now a Board-EQB).[4]

The applicant proposes to conduct onsite inspections of transmission facilities annually either on foot, by snowmobile, or by truck. Minor restorative maintenance, including insulator replacement, conductor repair, and tightening of hardware, will be performed as necessary. Such activity generally requires only limited equipment and manpower. Additionally, special land or air patrols will be conducted as necessary to locate and/or alleviate specific line or ROW problems. Extensive structural damage resulting from wind or ice storms or similar destructive phenomena will involve use of heavy construction equipment and considerable manpower.

### 2.6.2.2 Right-of-Way

Management plans and practices for the transmission ROW and access routes will be negotiated with property owners (ER, Sec. 4.1.4.2) so that such practices will be compatible with agricultural land uses where appropriate. Aside from certain limited special land uses, the general practices employed by the applicant will be oriented toward maximizing wildlife food and cover habitat (ER, App. Aa, Sec. 1.0).

#### Vegetation Control

The applicant's general plan for controlling vegetation entails maintaining herbaceous vegetation in the central one-third of the ROW (ER, App. Aa, Sec. 2.0). Portions of the ROW peripheral to the herbaceous section will be managed to selectively promote the development of a variety of herbs, shrubs and low-growing trees that are beneficial to wildlife. The presence of trees (including northern white cedar, red cedar, juniper, and ironwood) will be limited to areas adjacent to ROW boundaries. In selected upland sites, consideration will be given to planting fruit-bearing shrubs and trees in order to improve existing wildlife habitat. ROW management to improve game habitat in agricultural areas will be coordinated with individual land owners. The applicant will encourage the establishment of pastures and the development of wildlife food and cover in the vicinity of fence lines and line towers.

Special ROW management practices will be employed to benefit specific wildlife species. Areas near known or potential deer yards will be managed to maximize quantities of grasses, sedges, and other herbaceous plants available for early spring grazing. Areas of the ROW in closer proximity to deer yards will be managed so that the vegetation consists entirely of shrubs and tree saplings, thus increasing the availability of winter forage. The swamp conifer type of vegetation will be managed to benefit deer, as well as other wildlife. Woodcock habitat will be improved by periodic cutting in mature alder communities. Waterfowl food and nesting cover will be developed and maintained in areas where the ROW crosses major streams and marshes. Additional practices and more detailed information are presented in Appendix Aa of the applicant's Environmental Report.

Both mechanical techniques and chemical applications will be used to control ROW vegetation. The schedule for mechanical control methods will generally be once every three years; that for chemical control methods, once in three to five years (ER Supp., Resp. to Q. 26). Equipment used for mechanical control methods will consist of "boom trucks" and hand tools normally associated with tree trimming. Truck-mounted and back-pack sprayers will be used to apply chemicals. For the most part, control practices will be conducted to selectively preserve the vegetation that is particularly beneficial to wildlife. In the event that selective control measures are not feasible, the applicant may utilize overland vehicles or aircraft for applying herbicides (silvicides) provided desirable vegetation types are clearly marked and avoided during spray applications (ER Supp., Resp. to Q. 30).

Chemicals used in ROW maintenance will be limited to those herbicides (silvicides) and methods of application approved by the Minnesota Department of Agriculture and the U.S. Environmental Protection Agency (ER Supp., Resp. to Q. 30). Further, the applicant will be required to notify the Minnesota Department of Natural Resources as to the name(s), application rates, carrier agent(s) and application methods to be employed at least two days before chemical control activities are begun. Other principal limitations relative to the application of herbicides are as follows (ER Supp., Resp. to Q. 30). Aerial applications will be prohibited in buffer areas of at least 300 to 400 feet surrounding water bodies. The corresponding distance for landbased applications is 100 feet. Depending upon agreements with affected landowners, the applicant may be responsible for weed control under and around facility structures placed in agricultural croplands. The applied herbicides shall be compatible with the crops produced in the vicinity of the structures and aerial applications will be prohibited if the landowner so desires, as prescribed by the Minnesota EQB.[5]

The applicant has not specified the kinds of herbicides, carrier agents, and dosage rates to be used. Currently, appropriate agencies of the State of Minnesota are deliberating criteria that will prescribe allowable future use of herbicides in Minnesota.

# 3. THE AFFECTED ENVIRONMENT

## 3.1 LAND USE

### 3.1.1 Land Ownership Patterns

The specific patterns of the land crossed by the proposed transmission line are discussed here; Figure 2.1 outlines the proposed route and shows the county boundaries along the route.

Beginning in St. Louis County, the southernmost part of the line is dominated by privately owned lands (75%) with nearly one-half of these lands being owned by mining industries (32%). The lines will also cross minor amounts of state (10%) and county (15%) lands (see Table 3.1). Within Itasca County, most of the land crossed is owned by the county itself (70%). State-owned lands (19%) are crossed next most frequently, with private lands occupying only 11% of the route. In Koochiching County, the dominant land category shifts from private or county to state lands, which occupy over half the right-of-way (64%). The remaining lands are split evenly between private and state-owned lands (21% and 15%, respectively). The small section of the line routed through Beltrami County runs entirely on state-owned lands. The only Federal lands crossed by the proposed line are within Lake of the Woods County, and these amount to only 2% of the total area crossed by the line in this county. The dominant land-ownership category of the right-of-way in Lake of the Woods County is again state lands (87%), with private lands only occupying 11%. This pattern continues again in Roseau County with state land occupying 70% of the total, with private ownership occupying the rest. In summary, the majority of land crossed by the proposed line is state land (57%) followed by privately owned land (22%), county land (16%), mining industry land (5%), and less than one percent Federal land.

#### 3.1.1.1 Federal

A total of 20 acres (8.1 ha) of Federal land will be crossed by the proposed route. These are designated as Land Utilization Project lands and are leased to the state for 90 years. At one time, these lands were in private ownership but the government purchased the land from settlers who could not make a living off this acreage with its bog-like characteristics and poor agricultural and forest productivity. These lands are to be used for forestry, wildlife, and recreation only, and written permission to erect any structures on the land must be obtained from the U. S. Department of Interior.

#### 3.1.1.2 State

A total of approximately 2500 (1000 ha) acres of state land will be occupied by the proposed right-of-way, over one-half of the entire project. Most of these acres are state forest lands, extending across parts of George Washington State Forest, Koochiching State Forest, Pine Island State Forest, and Beltrami Island State Forest. These forested lands are to be used to produce forest products, protect watershed areas, preserve rare and distinctive flora and fauna, and provide recreation.

#### 3.1.1.3 County

A total of about 685 acres (277 ha) of county-owned lands will be crossed by the proposed line. The majority lie within Itasca and Koochiching Counties and some in St. Louis County. There appears to be no general designated use for these lands.

#### 3.1.1.4 Private

Private lands, including those owned by mining companies, occupy the second largest category of lands found within the right-of-way and total approximately 1150 acres (465 ha). Over one-half of these lands are located in St. Louis County, with most of the rest within Koochiching and Roseau Counties. Farming and foresty predominate on those lands not committed to mining.

Table 3.1. Land Ownership by County for the Proposed Transmission Line[a]

| County | Federal | State | County | Private | Mining Co. | Total |
|---|---|---|---|---|---|---|
| St. Louis | | | | | | |
| Miles of right-of-way | - | 2.83 | 4.41 | 12.46 | 9.13 | 28.83 |
| Acres of right-of-way[b] | - | 62 | 96 | 272 | 200 | 630 |
| Itasca | | | | | | |
| Miles of right-of-way | - | 5.42 | 20.1 | 3.26 | - | 28.78 |
| Acres of right-of-way[c] | - | 99 | 366 | 59 | - | 524 |
| Koochiching | | | | | | |
| Miles of right-of-way | - | 42.66 | 10.19 | 14.41 | - | 67.26 |
| Acres of right-of-way[b] | - | 931 | 222 | 314 | - | 1467 |
| Beltrami | | | | | | |
| Miles of right-of-way | - | 6.87 | - | - | - | 6.87 |
| Acres of right-of-way[b] | - | 150 | - | - | - | 150 |
| Lake of the Woods | | | | | | |
| Miles of right-of-way | 0.92 | 32.76 | - | 4.01 | - | 37.69 |
| Acres of right-of-way | 20 | 715.0 | - | 88 | - | 823 |
| Roseau | | | | | | |
| Miles of right-of-way | - | 23.86 | - | 10.09 | - | 33.95 |
| Acres of right-of-way | - | 521 | - | 220 | - | 741 |
| Total | | | | | | Grand Total |
| Miles | 0.92 | 114.40 | 34.70 | 44.23 | 9.13 | 203.38 |
| Acres | 20 | 2478 | 684 | 953 | 200 | 4335 |

[a]Personal communication from Mr. Norman Moody, Northern States Power Company.

[b]180-foot wide cleared right-of-way.

[c]150-foot wide cleared right-of-way.

## 3.1.2 Land Resources

### 3.1.2.1 Agriculture

A total of only 135 acres (55 ha) will be taken out of production during the construction of the proposed line. Typical crops produced in the four-county area include hay, wheat, oats, and flax. Table 3.2 lists the average yield and price per crop for the four counties in which the line will cross agricultural land. Table 3.3 lists the number and average value for different types of livestock in the same four-county areas. The applicant has indicated (ER, Fig. 1.3-7a) that the line will cross cultivated land only in Lake of the Woods and Roseau Counties. No prime agricultural lands are traversed by the proposed route.

### 3.1.2.2 Forestry

As indicated in Table 3.4, a total of 2430 acres (983 ha) of forested land will be crossed by the proposed route. Of this total, 1340 acres (542 ha) are aspen or spruce. The current average stumpage price (1975-1976) for cordwood from state lands is $5.50/cord. The Minnesota Department of Natural Resources generally figures either 60 to 1 or 70 to 1 multipliers to obtain the average total value in finished products (paper, pulpwood) per cord of wood in Minnesota.[1] However, this multiplier does not take into consideration the possibility that the timber may never reach the market because of price and/or disease, fire or other destructive forces.

Table 3.2. Crop Data for Counties Crossed by Proposed Line[a]

| Major Crops | County | | | |
|---|---|---|---|---|
| | St. Louis | Itasca | Lake of the Woods | Roseau |
| Hay | | | | |
| Total acres harvested | 60,000 | 36,900 | 26,000 | 89,000 |
| Average yield/acre | 1.1 tons | 1.1 tons | 1.3 tons | 1.4 tons |
| Season average price for state | $70.50/ton | | | |
| All Wheat | | | | |
| Total acres harvested | 900 | 600 | 18,700 | 119,600 |
| Average yield/acre | 30.1 bushels | 22.0 bushels | 32.6 bushels | 37.4 bushels |
| Season average price for state | $2.99/bushel | | | |
| Oats | | | | |
| Total acres harvested | 5,100 | 4,400 | 9,600 | 61,000 |
| Average yield/acre | 58.3 bushels | 43.3 bushels | 67.6 bushels | 62.4 bushels |
| Season Average price for state | $1.50/bushel | | | |
| Flax | | | | |
| Total acres harvested | | | | 48,100 |
| Average yield/acre | | | | 13.7 bushels |
| Season average price for state | | | | $7.20/bushel |

[a]From "Minnesota Agricultural Statistics, 1977," Minnesota Department of Agriculture, May, 1977.

Table 3.3. Livestock Numbers and Value for Four Counties Crossed by Proposed Line, 1977[a]

| Class | County | | | |
|---|---|---|---|---|
| | St. Louis | Itasca | Lake of the Woods | Roseau |
| Cattle, all | 19,000 | 19,000 | 12,300 | 40,100 |
| Value/head | $235.00 | | | |
| Hogs and pigs, all | 700 | 2,300 | 700 | 2,300 |
| Value/head | $ 46.50 | | | |
| Sheep and lambs, all | 500 | 500 | 400 | 11,000 |
| Value/head | $ 33.50 | | | |
| Chickens, all | 120,000 | 10,000 | 2,000 | 10,000 |
| Value/head | $ 1.55 | | | |

[a]From "Minnesota Agricultural Statistics, 1977," Minnesota Department of Agriculture, May, 1977.

Table 3.4. Land Resources within the Proposed Route[a]

| Network | Forested | Agricultural |
|---|---|---|
| 1 | | |
| Miles of right-of-way | 27.9 | 1.4 |
| Acres impacted | 524 | 30 (0.2)[b] |
| No. of acres of aspen/spruce | _/[c] | - |
| Fields crossed | - | _/[c] |
| 2 | | |
| Miles of right-of-way | 43.2 | - |
| Acres impacted | 865 | - |
| No. of acres of aspen/spruce | 784 | - |
| Fields crossed | - | 0 |
| 3 | | |
| Miles of right-of-way | 24 | .7 |
| Acres impacted | 505 | 15 (0.2)[b] |
| No. of acres of aspen/spruce | 387 | - |
| Fields crossed | - | 3 |
| 4 | | |
| Miles of right-of-way | 25 | 4.1 |
| Acres impacted | 536 | 90 (1.3)[b] |
| No. of acres of aspen/spruce | 169 | - |
| Fields crossed | - | 25 |
| Total | | |
| Acres impacted | 2430 | 135 (1.7)[b] |
| Acres of aspen/spruce (Networks 2, 3, and 4) | 1340 | - |
| Fields crossed (Networks 2, 3, and 4) | - | 28 |

[a]Derived from FEIS, 1976, and response to Q. 24.

[b]Figures in parentheses equal the number of acres occupied by structures and unavailable for use during operation of line.

[c]Not available.

### 3.1.3 Recreational Patterns

There are a total of 204 recreational sites within the corridor boundaries of the six-county area.[2] These sites include federal (national forest), state (state parks and state forests), county (county memorials), municipal (municipal parks), and private (resorts) lands. The majority of these recreation areas are located in St. Louis, Itasca, and Lake of the Woods Counties. Table 3.5 summarizes the number, kind, and size of these areas for each county within the corridor, and Figure 3.1 outlines the public areas. Some of the kinds of facilities found at these recreation areas include campgrounds, picnic areas, trails, fishing, swimming, and playgrounds. Table 3.6 lists the size, number of campsites available, and the attendance for both 1976 and 1977 of all the state parks in the six-county area. The state parks contain a total of 486 campsites with 27 having electric hook-ups at Lake Bemidji State Park. The state forests also provide some campsites; in addition, they provide for recreational activities such as hunting and trail use. Wildlife management areas generally have no camping areas but do provide for such activities as hunting, trapping and fishing.

Table 3.5. Recreational Areas in the Six-County Area[a]

| | | Federal | State | County | Municipal | School | Private | Total |
|---|---|---|---|---|---|---|---|---|
| Beltrami | Number | -- | 2 | -- | -- | 1 | -- | 3 |
| | Total size (in acres) | -- | 145,040 | -- | -- | 40 | -- | |
| | Type | -- | | -- | -- | Sch. F. Ath. Flds. | -- | |
| Itasca | Number | 2 | 33 | 4 | 3 | -- | 23 | 65 |
| | Total size (in acres) | 23 | 358,780 | 144,018 | 16.8 | -- | 690.7 | |
| | Type | PA, CG | SF, PA, PIC, CG | CM | M. PK | -- | Resorts CG | |
| Koochiching | Number | -- | 7 | 2 | -- | 3 | 1 | 13 |
| | Total size (in acres) | -- | 844,520 | 25 | -- | 40 | -- | |
| | Type | -- | SF, PA | C. PK | -- | Sch. F. Ath. Flds. | Resorts | |
| Lake of the Woods | Number | -- | 15 | 1 | -- | 5 | 25 | 46 |
| | Total size (in acres) | -- | 578,938 | 40 | -- | 164 | 596 | |
| | Type | -- | SPK, SF, | C. For | -- | Sch. F. Ath. Flds. | Resorts | |
| Roseau | Number | -- | 10 | -- | -- | 2 | 1 | 13 |
| | Total size (in acres) | -- | 208,937 | -- | -- | 130 | 15 | |
| | Type | -- | SF, WMA, SPK | -- | -- | Sch. F. Ath. Flds. | Resorts | |
| St. Louis | Number | 1 | 23 | 2 | 23 | 8 | 7 | 64 |
| | Total size (in acres) | -- | 7,132 | -- | 347 | -- | 360 | |
| | Type | N.F. | PA, SPK, WR | PA | M. PK | Ath. Flds. | Resorts, CG | |
| Total | Number | 3 | 90 | 9 | 26 | 19 | 57 | |
| | Total size | -- | 2,143,347 | 144,083 | 364 | 374 | 1,662 | |

[a]Derived from Minnesota Outdoor Recreation Area Inventory for Beltrami, Itasca, Koochiching, Lake of the Woods, Roseau and St. Louis Counties. Abbreviations in table are:

Sch. F = School forest
Ath. Flds = Athletic fields
PA = Public access
CG = Campground
SF = State forest
PIC = Picnic ground
SPK = State park
WR = Wildlife refuge
WMA = Wildlife management area
N.F. = National forest
M. PK = Municipal Park
C. For = County forest
C. PK = County park
CM = County memorial

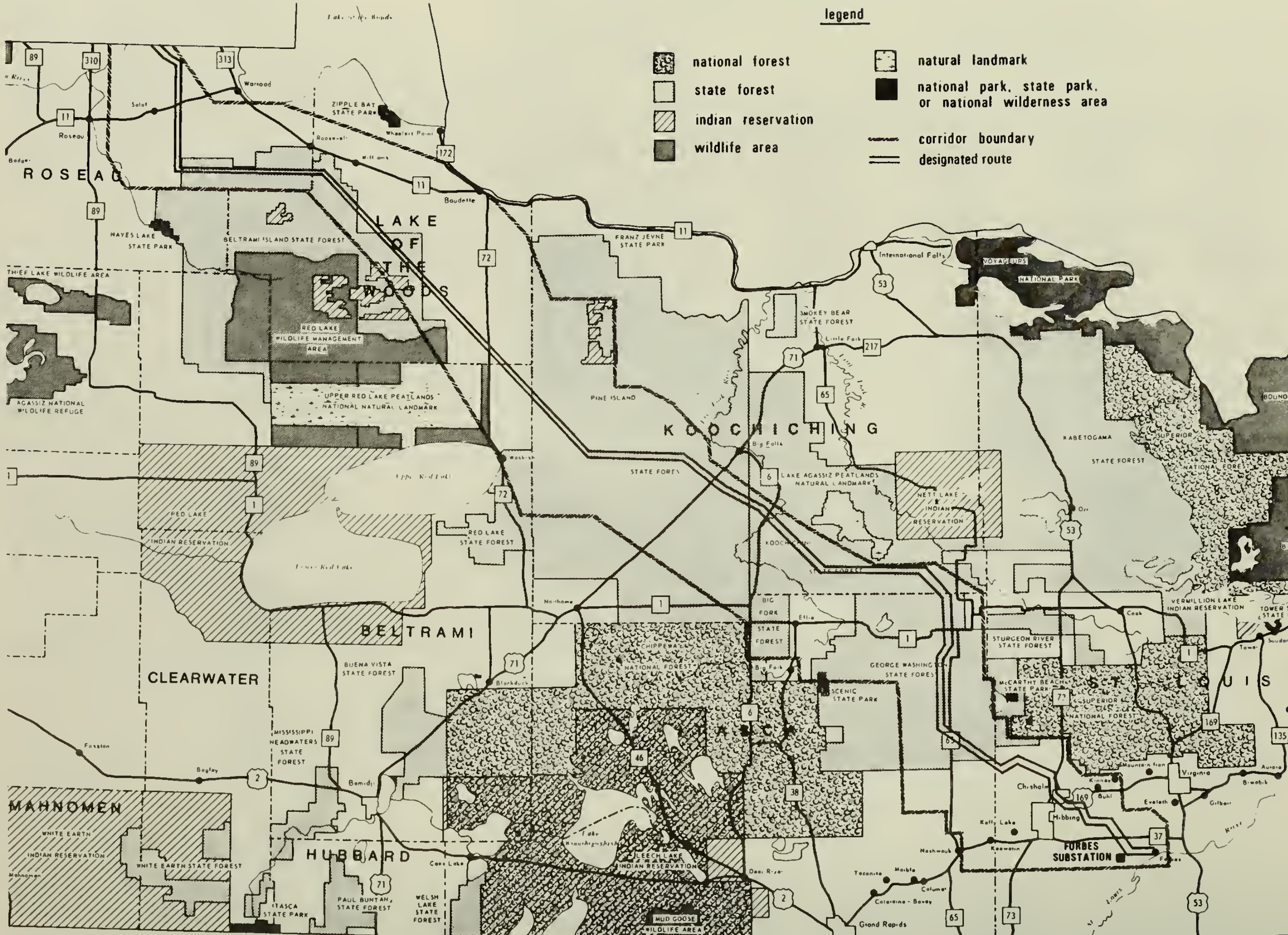


Fig. 3.1. Regional Setting. Modified from ER, Fig. 1.2-1.

Table 3.6. Campsites in the State Parks in the Six-County Area[a]

| County | State Park | Size (acres) | Attendance 1970 | Attendance 1977 | No. of Campsites |
|---|---|---|---|---|---|
| Beltrami | Lake Bemidji | 1,717 | 120,952 | 95,126 | 113 |
| Itasca | Schoolcraft | 295 | 9,370 | 9,016 | 138 |
| | Scenic | 1,632 | 47,845 | 60,487 | 120 |
| Koochiching | None | | | | |
| Lake of the Woods | Zippel Bay | 2,946 | 26,768 | 25,215 | 50 |
| Roseau | Hayes Lake | 2,950 | 30,340 | 31,981 | 20 |
| St. Louis | McCarthy Beach | 2,564 | 123,001 | 100,683 | 81 |
| | Tower Soudan | 1,000 | 78,249 | 77,822 | - |
| | Bear Head Lake | 4,375 | 37,754 | 40,287 | 74 |

[a]From Minn. Dept. of Natural Resources, Div. of Parks.

## 3.2 SOILS AND GEOLOGY

### 3.2.1 Soils

Detailed soil surveys are not available for much of the proposed project area. However, the University of Minnesota Agricultural Experiment Station, in cooperation with other organizations and individuals, is currently preparing the "Minnesota Soil Atlas." The "Hibbing Sheet" of the Atlas has been published[3] and includes the area traversed by Network 1 and the southeastern portion (35%) of Network 2 (see Fig. 2.1). The "Roseau Sheet" is not yet published, but the applicant has provided working maps that depict soil patterns within and adjacent to the remainder of the proposed ROW (ER Supp., Resp. to Q. 14).

The principal mapping units identified in the Minnesota Soil Atlas are "geomorphic regions" and "soil landscape units."[3] The former is used to designate broad physiographic features and identify the parent materials from which the soils have developed. Soil landscape units are delineated within geomorphic regions. The criteria for classifying soil landscape units are as follows: the texture of the soil material below five feet (1.5 m), the texture of the surface materials, drainage characteristics, and the color of the surface soil as an indicator of organic matter accumulation.

From the Forbes substation, Network 1 (Fig. 2.1) of the proposed transmission line extends northwesterly traversing portions of five geomorphic regions, in order and characterized as follows:

1. Upham Lacustrine Plain (6 miles, 9.6 km)--A large nearly level basin formerly occupied by glacial Lake Upham.

2. Aurora Till Plain, Red Clayey (12 miles, 19 km)--Glacial till is a reddish-brown calcareous silt clay in rolling to hilly topography with numerous potholes and small peat bogs.

3. Mesabi Range (1.5 miles, 2.4 km)--Includes the Giants Range and Mesabi Iron Range, some portions 400-500 feet (122-137 m) above the bordering plains. The area is covered with stony glacial drift of loamy sand to sandy loam textures.

4. Nashwauk-Warba Moraine, Brown (21 miles, 34 km)--A thick deposit of brown-colored calcareous, clay loam glacial till covers this region of generally rolling terrain.

5. Prairie River Plain, Sandy (5 miles, 8 km)--Sediments in this gently rolling to nearby level region are predominantly water deposited, deep brownish colored, acid, fine and medium sands.

Networks 3 and 4, and essentially all of Network 2, are within the Agassiz Lacustrine Plain that is differentiated into the Big Fork Valley, Red Lake and Beltrami areas, and the Agassiz Peatlands. The lacustrine clays occurring in the glacial lake basin are variously interrupted by sandy beach ridges that developed between successive fluctuations of water levels in the former Lake Agassiz.

The soil landscape units occurring in the proposed transmission ROW have been tabulated in accordance with transmission line networks shown in Figure 2.1. The following summary indicates landscape units by network, as well as the relative areal extent (%) that a given landscape unit occurs within the transmission ROW.

| Soil landscape units[a] | Percentage of ROW |
|---|---|
| Network 1 | |
| Deep silty or loamy, well drained, light colored soils | 40 |
| Clayey over clayey, well drained, light colored soils | 27 |
| Sandy over sandy, well drained, light colored soils | 12 |
| Sandy over clayey, poorly drained, light colored soils | 9 |
| Organic soils | 9 |
| Silty or loamy over rock, well drained, light colored soils | 3 |
| Network 2 | |
| Acid peat | 29 |
| Organic soils | 18 |
| Clayey over clayey, poorly drained, dark colored soils | 16 |
| Sandy over sandy, well drained, light colored soils | 6 |
| Sandy over sandy, poorly drained, light colored soils | 6 |
| Clayey over clayey, poorly drained, light colored soils | 5 |
| Nonacid peat | 4 |
| Clayey over clayey, well drained, light colored soils | 4 |
| Sandy over clayey, poorly drained, light colored soils | 3 |
| Others (includes 4 units, all poorly drained) | 9 |
| Network 3 | |
| Sandy over sandy, well drained, light colored soils | 31 |
| Peat over sand deposits | 16 |
| Peat over loam | 14 |
| Loamy over loamy, poorly drained, light colored soils | 11 |
| Loamy over sandy, poorly drained, dark-colored soils | 10 |
| Sandy over sandy, poorly drained, dark-colored soils | 10 |
| Nonacid peat | 6 |
| Loamy over loamy, well drained, light colored soils | 3 |
| Network 4 | |
| Loamy over loamy, poorly drained, dark colored soils | 33 |
| Sandy over sandy, well drained, light colored soils | 29 |
| Loamy over sandy, poorly drained, dark colored soils | 13 |
| Peat over loam | 11 |
| Peat over sand deposits | 10 |
| Nonacid peat | 2 |

[a]Note: See criteria for designating landscape units previously discussed in this section.

### 3.2.2 Surficial Geology

The surficial deposits are mostly glacial till (the Des Moines lobe of Wisconsinan age), which are largely covered by peat and swamp muck.[4,5] Some drumlin fields are present in the southeastern part of the transmission line route, but most of the route traverses the flat, swampy area which was occupied by glacial Lake Agassiz about 13,000 years ago. The peat deposits include decayed vegetation which shows the transition from tundra and spruce immediately following glaciation to red and jack pine typical of the present climate.[5]

## 3.3 HYDROLOGY

The corridor lies within three major watershed basins--Hudson Bay, Lake Superior, and Mississippi River Basins.[6,7] The major hydrological features in the corridor are six river systems, a small number of lakes, and the Big Bog, which is part of the bottom of the glacial lake, Lake Agassiz.[6]

### 3.3.1 Streams

The corridor traverses six stream drainage basins (Fig. 3.2). Five, including the Little and Big Fork Rivers, Red River, Rainy River, and Roseau River basins, are located in the Hudson Bay drainage (Figs. 3.3 to 3.6). The St. Louis River basin is the only major subdivision of the Lake Superior watershed (Fig. 3.7). As the corridor crosses only the extreme northeast corner of the Mississippi River basin, no major subdivisions of that drainage are associated with the proposed project (ER, Sec. 1.3.2). Seventeen streams are the only bodies of open water actually crossed by the line (Table 3.7). In addition, the watersheds of 12 additional streams are crossed by the right-of-way. Finally, all streams are listed in order from northwest to southeast and classified by drainage basin in Table 3.7 (ER Supp., Resp. to Q. 15).

The only portions of the St. Louis watershed affected by the proposed project are stream tributaries to the St. Louis River in the northeastern portion of the drainage (Fig. 3.7). The St. Louis watershed area in northeastern Minnesota totals 3584 $mi^2$ ($9.2 \times 10^3$ $km^2$) and is part of the Mesabi Range. The streams to be crossed are generally of low gradient, slow, and often colored with bog water. The water is soft and poorly buffered. Recreational use of this portion of the watershed is limited.[6]

The Little Fork watershed, by contrast, is noted for its wilderness characteristics.[8] The La Vallee (Valley), a stream in this basin, is the only trout stream crossed by the ROW (ER Supp., Resp. to Q. 15). In addition, the Bear and Prairie Rivers are crossed. Streams in this watershed are generally wilder and more remote, with an abundance of falls and rapids. The total drainage equals 1849 square miles.[6]

Four streams in the Big Fork River basin are crossed by the proposed ROW. They are the Big Fork itself, Reilly Brook, Dinner Creek, and the Sturgeon River. The watershed here is 2063 $mi^2$ ($5.34 \times 10^3$ $km^2$) and its main feature is the Big Fork River, which was designated in 1970 as a study stream in the National Wild and Scenic Rivers System. Thomas Waters concludes that "the Big Fork is one of Minnesota's best candidates for inclusion in the national rivers' protection program. It is a canoe stream of the highest quality."[6]

The proposed ROW touches the Red River of the North at two points (Fig. 3.5). The first is at the northeast side of the drainage, as the line leaves Koochiching County and enters Beltrami County. No streams are crossed in this portion of the basin (ER Supp., Resp. to Q. 15). The second point is located at the Canadian-U.S. border in the Roseau River portion of the watershed. Its size is 1150 $mi^2$ ($2.98 \times 10^3$ $km^2$) in the U.S. and an additional 440 $mi^2$ ($1.14 \times 10^3$ $km^2$) in Canada. The line crosses no streams in the watershed, but passes close to the drainages of Sprague and Hay Creeks. Both creeks drain into the Roseau River, which encompasses the Roseau River Wildlife Management Area. The river has been proposed for extensive channelization by the Corps of Engineers.[6]

Between the two portions of the Red River of the North watershed lies the Lower Rainy River and Lake of the Woods drainage. The line crosses nine water courses--Troy Creek, Chase Brook, Rapid River, North Branch of Rapid River, Peppermint Creek, Winter Road River, Clausner Creek and the East and West Branches of the Warroad River (Fig. 3.6). (Ref. 6 and ER Supp., Resp. to Q. 15). All but the Warroad flow into the Rainy River, which in turn flows into Lake of the Woods. The Warroad and its branches flow directly into the lake. The Lower Rainy River consists of that portion downstream of Rainy Lake and International Falls. The lower portion and its tributaries flow slowly in the flat, swamp glacial bed of Lake Agassiz. The total watershed of the Rainy is 13,805 $mi^2$ ($3.58 \times 10^4$ $km^2$), both in the U.S. and Canada. The Rainy and its tributaries all drain the bog in this area. The Warroad drains the northern portions of the Beltrami Island State Forest, which grows on one of the glacial beach formations of Lake Agassiz (see Sec. 3.3.3).

In general, the watersheds crossed by the proposed line bear warm water rivers. Those in the northwestern parts of the route generally drain the bog; they generally are slow moving and have low gradients, mud or muck bottoms, and dark-stained soft waters of low pH. The rivers in the southeast portion crossed by the ROW have steeper gradients and frequently sand-gravel substrates. In many cases, however, the water is still darkened due to the ubiquitous influence of the bog. (Ref. 6; ER Supp., Resp. to Q. 15; ER, Sec. 1.3.2).

### 3.3.2 Lakes

There are few lakes within the proposed corridor (ER, p. 1.3-12, Fig. 1.3-4). The term "lake" is defined as a body of water ten acres (4 ha) or more in size (Fig. 3.8).[9] The majority of the lakes in northeastern Minnesota are oligotrophic; however, the proposed route does not impact these bodies of water.[7] The corridor does pass within one mile of small groups of eutrophic lakes in St. Louis and Itasca Counties (Table 3.8), as well as one lake (Norquist) in Lake of the Woods County (ER Supp., Resp. to Q. 22). These lakes are generally less than 40 feet (12 m) in depth and 200 acres (80 ha) in size. Water quality varies little, and is typical of eutrophic

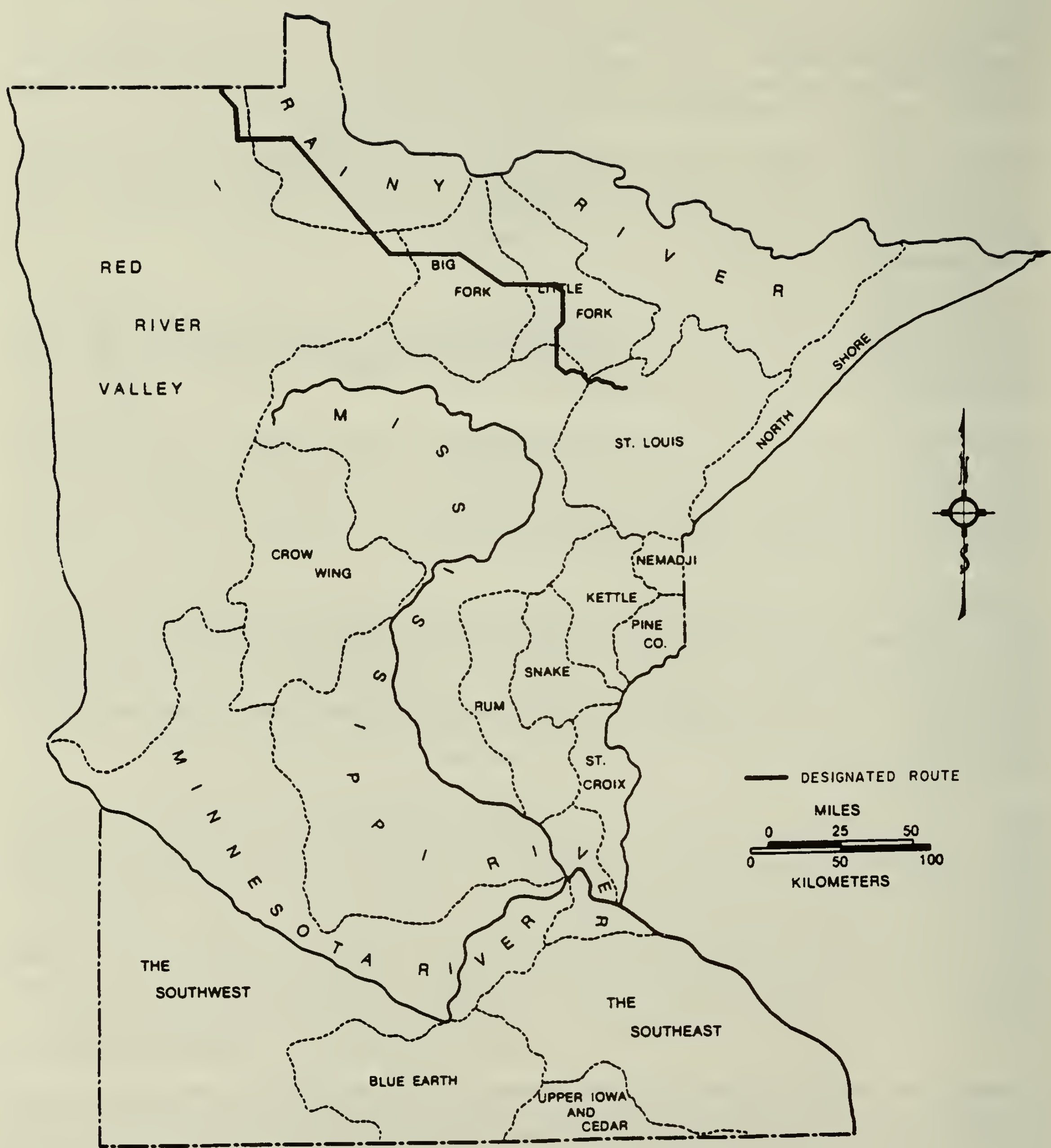


Fig. 3.2. Major Watersheds of Minnesota. Modified from T. E. Waters, "The Streams and Rivers of Minnesota."

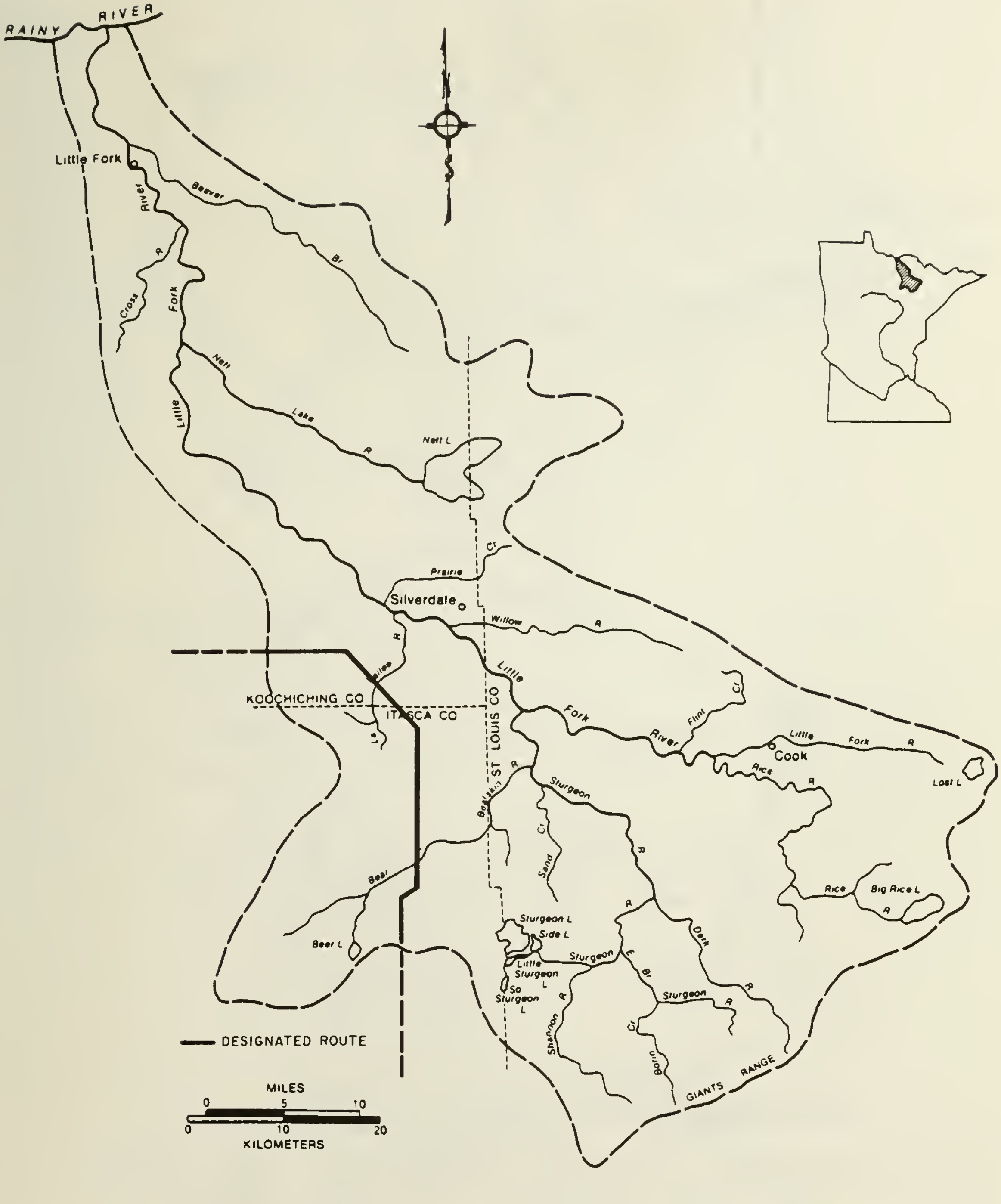


Fig. 3.3. The Little Fork River. Modified from T. E. Waters, "The Streams and Rivers of Minnesota."

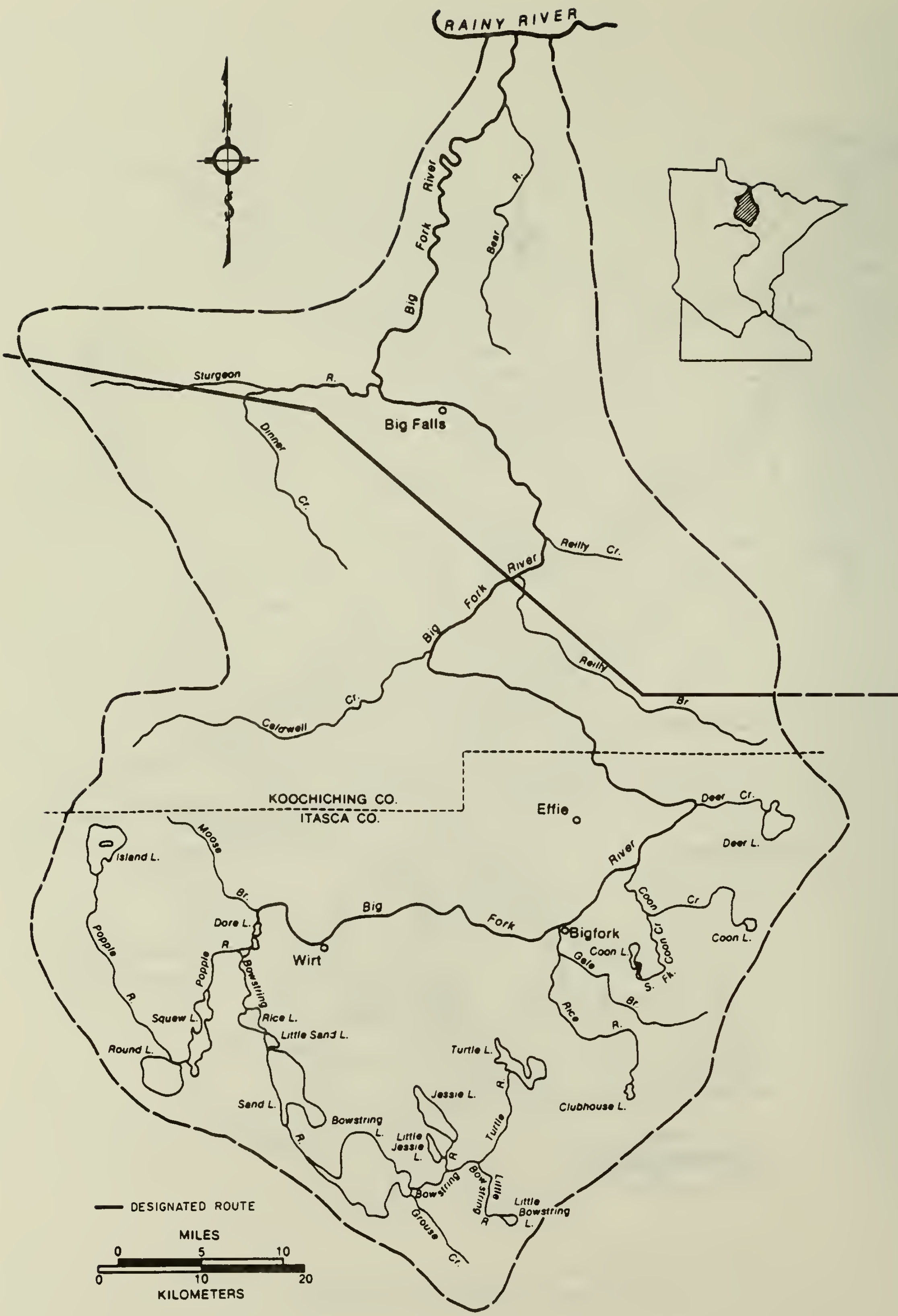


Fig. 3.4. The Big Fork River. Modified from T. E. Waters, "The Streams and Rivers of Minnesota."

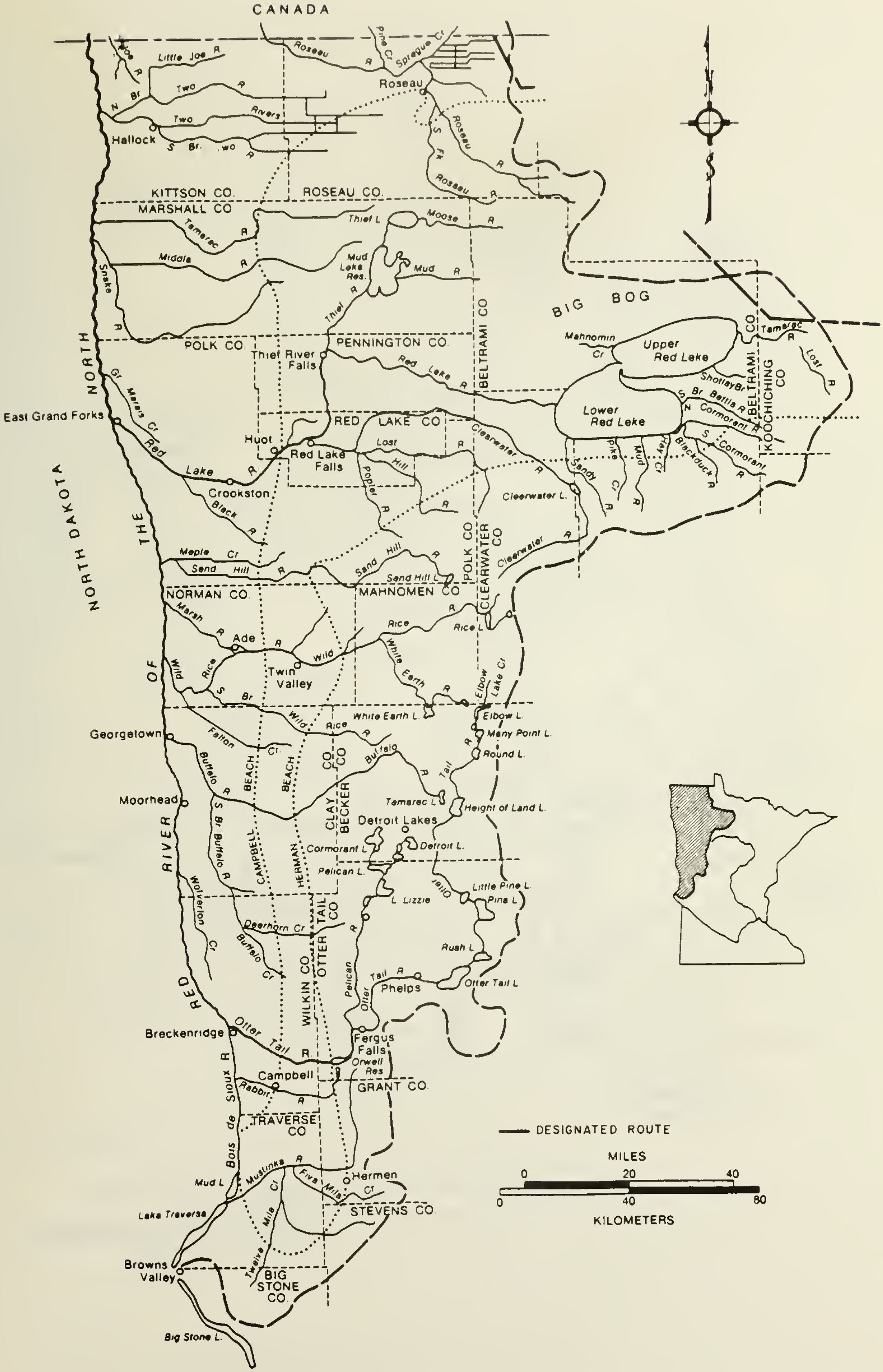


Fig. 3.5. Watersheds of the Red River of the North. Modified from T. E. Waters, "The Streams and Rivers of Minnesota."

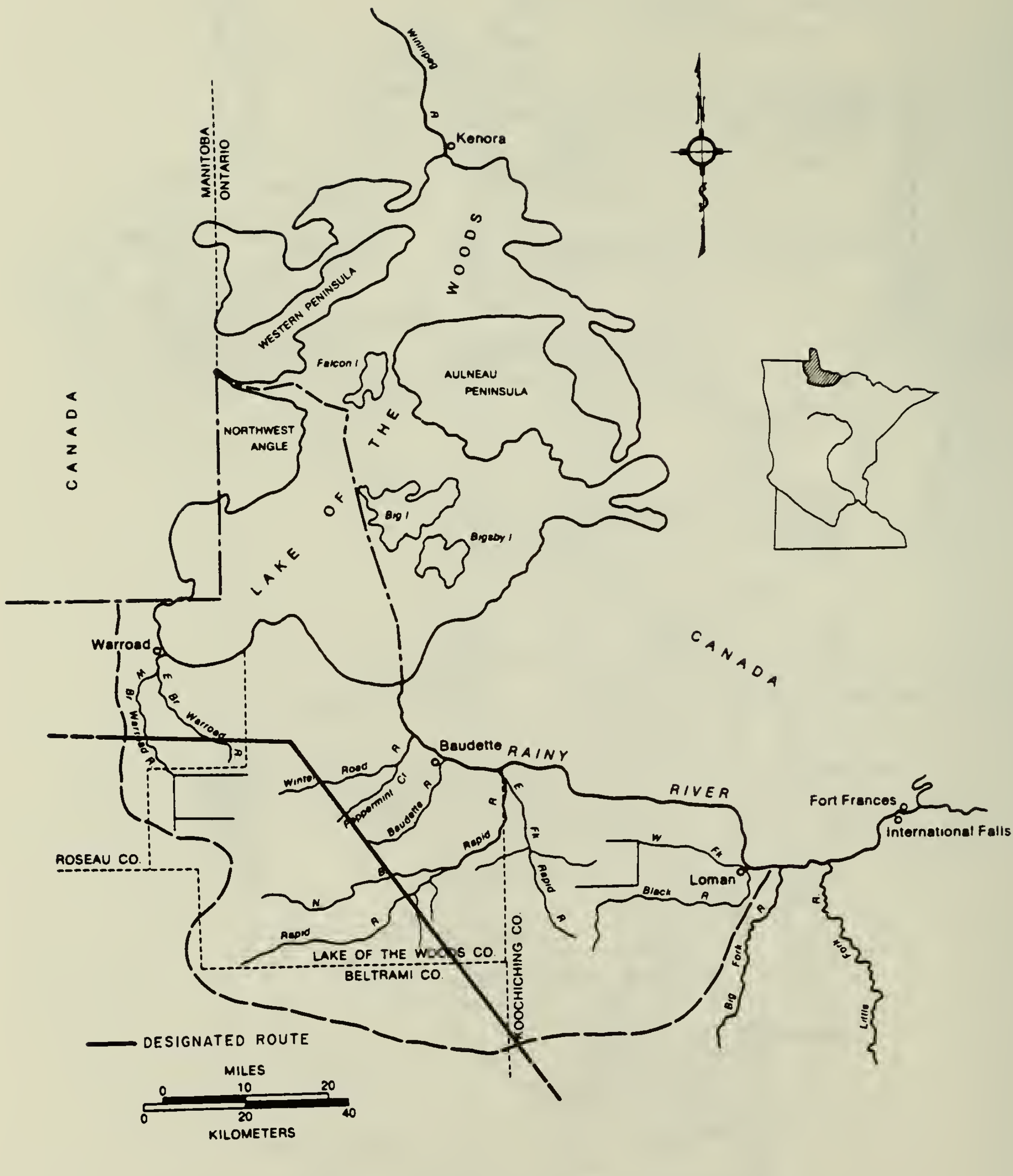


Fig. 3.6. The Lower Rainey River and Lake of the Woods. Modified from T. E. Waters, "The Streams and Rivers of Minnesota."

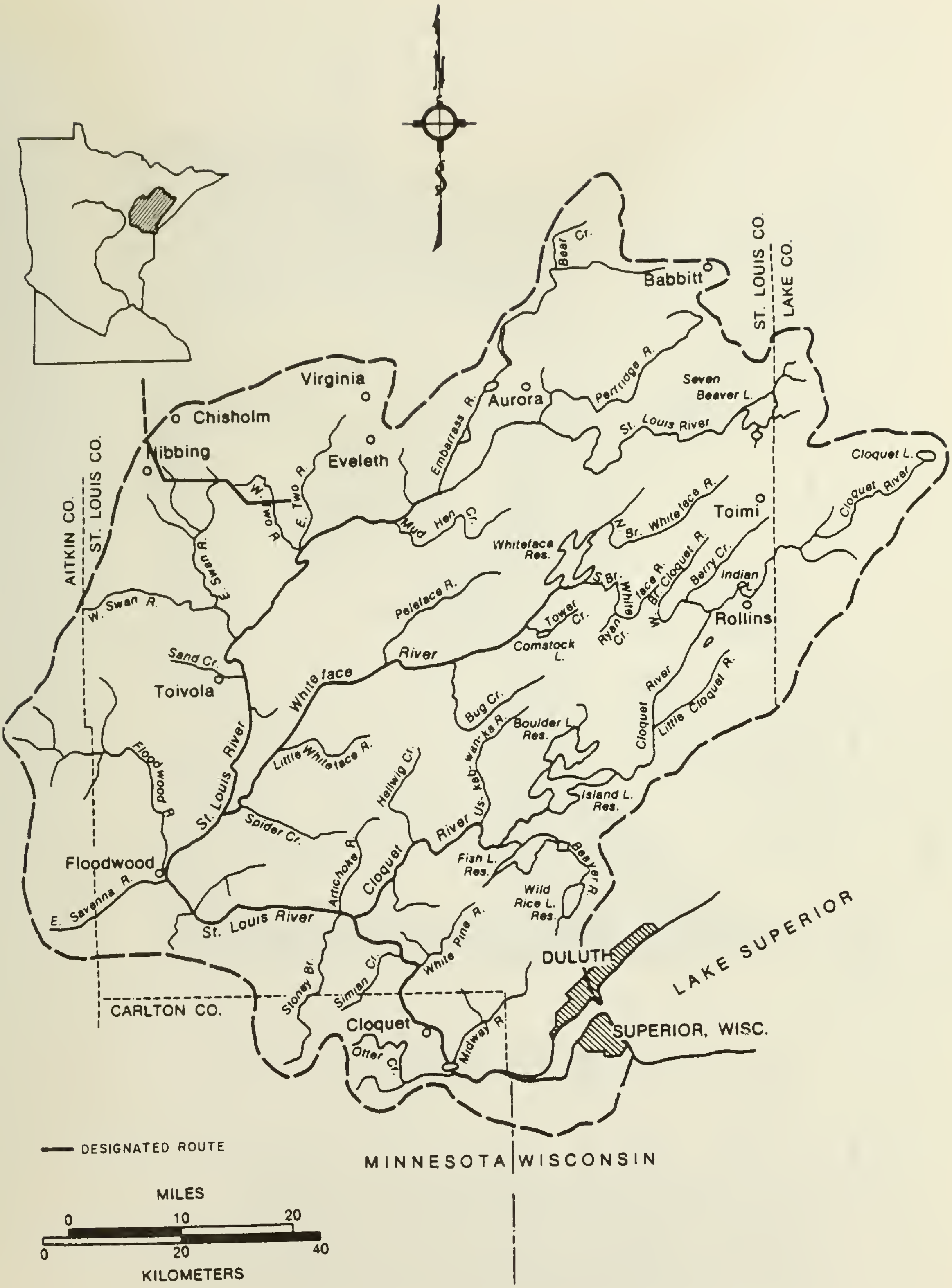


Fig. 3.7. Watersheds of the St. Louis River. Modified from T. E. Waters, "The Streams and Rivers of Minnesota."

Table 3.7. Major Streams and Rivers in the Corridor

| Stream | Crossed by ROW | Watershed | County | Major Drainage |
|---|---|---|---|---|
| Sprague Creek | NO | Red River of the North | Roseau | Hudson Bay |
| Hay Creek | NO | " | " | " |
| East Branch Warroad River | YES | Rainy River-Lake of the Woods | " | " |
| West Branch Warroad River | YES | " | " | " |
| Clausner Creek | YES | " | " | " |
| Clear River | NO | " | Lake of the Woods | " |
| Willow Creek | NO | " | " | " |
| Winter Road River | YES | " | " | " |
| Peppermint Creek | YES | " | " | " |
| Baudette River | NO | " | " | " |
| Rapid River | YES | " | " | " |
| North Branch Rapid River | YES | " | " | " |
| Chase Brook | YES | " | " | " |
| Troy Creek | YES | " | " | " |
| Tamarac River | NO | Red River of the North | Beltrami | " |
| Sturgeon River | YES | Big Fork River | Koochiching | " |
| Dinner Creek | YES | " | " | " |
| Caldwell Creek | NO | " | " | " |
| Reilly Brook | YES | " | " | " |
| Big Fork River | YES | " | Koochiching-Itasca | " |
| La Vallee (Valley) River | YES | Little Fork | Koochiching | " |
| Bear River | YES | " | Itasca | " |
| Prairie River | YES | " | Koochiching | " |
| Day Brook | YES | St. Louis | St. Louis | Lake Superior |
| East Swan River | YES | " | " | " |
| Dempsey Creek | YES | " | " | " |
| West Two River | YES | " | " | " |
| East Two River | NO | " | " | " |
| St. Louis River | NO | " | " | " |

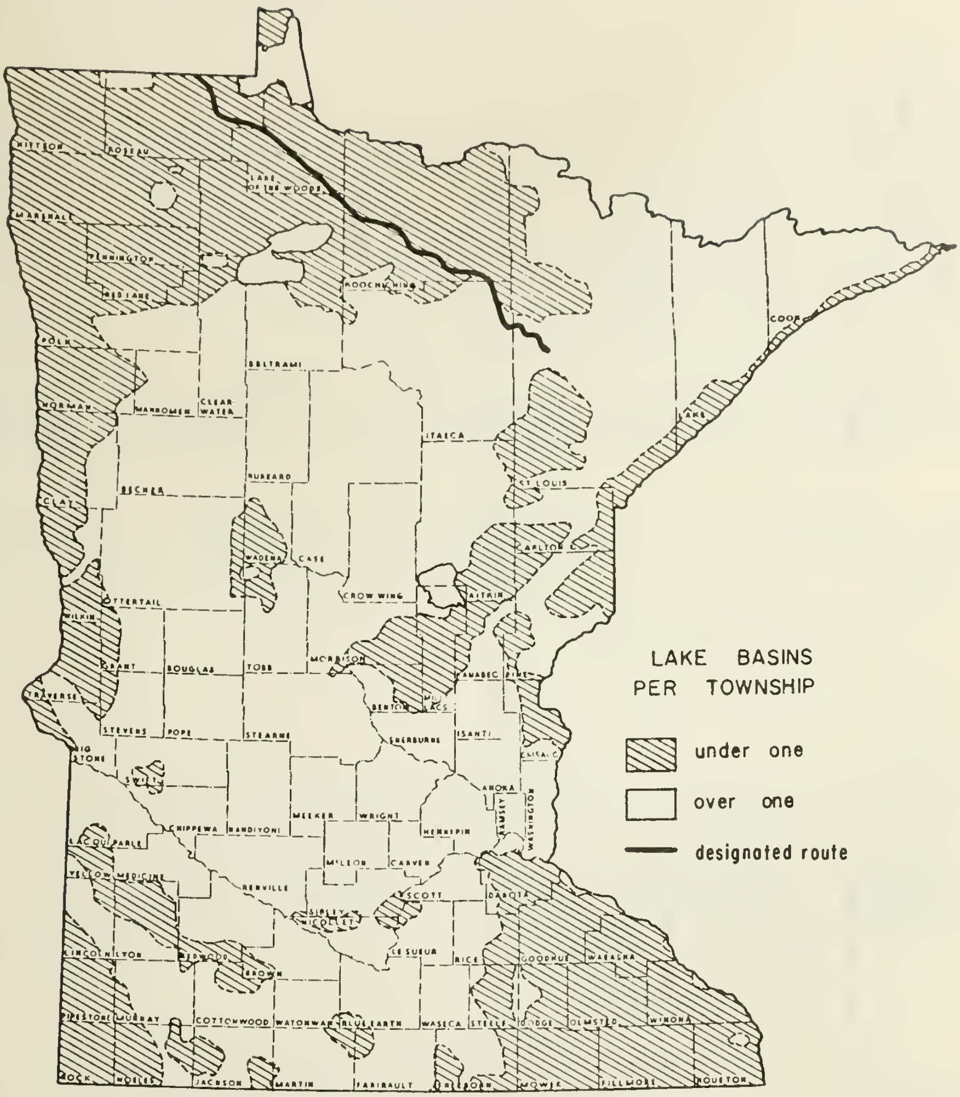


Fig. 3.8. Lakeless Region of Minnesota. From A. R. Peterson, Minn. DNR Sp. Publn. No. 107, 1974.

Table 3.8. Lakes within One Mile of the Proposed Tranmission Line (center line)

| St. Louis County | | Itasca County | | Lake of the Woods County | |
|---|---|---|---|---|---|
| Name | Reference Number[a] | Name | Reference Number[a] | Name | Reference Number[a] |
| Moran Lake | 69-938 | Spring Lake | 31-65 | Norquist Lake | 39-4 |
| Day Lake | 69-906 | Unnamed | 31-64 | | |
| Unnamed | 69-905 | Seven Lake | 31-71 | | |
| Rat Lake | 69-922 | Little Moose Lake | 31-162 | | |
| Rock Lake | 69-907 | Prairie Lake | 31-53 | | |
| Hobson Lake | 69-923 | Bower Lake | 31-52 | | |
| Sixmile Lake | 69-840 | Monson Lake | 31-50 | | |
| Little McQuade Lake | 69-774 | Unnamed | 31-40 | | |
| McQuade Lake | 69-775 | | | | |

[a]Reference numbers from "Inventory of Minnesota Lakes", Minn. Dept. of Conservation, Div. of Waters, Soils and Minerals, Bull. No. 25, 1968.

lakes except that the water is usually stained brown due to the influence of bogs in the area (ER Supp., Resp. to Q. 22). The lakes are located in areas of little geographic relief relative to the proposed corridor route. No steep gradients up or downslope are evident in these watersheds and the area is characterized by minimal erosion.

### 3.3.3 Wetlands

The most significant hydrologic feature in the corridor is the Big Bog (ER, Sec. 1.3.2). The bog is an extensive poorly drained region containing vast peat deposits, and was formerly the bottom of Lake Agassiz (Fig. 3.9).[9]

Lake Agassiz at its peak covered 200,000 $mi^2$ ($5.18 \times 10^5$ $km^2$) of North America. The lake was formed by a glacier that retreated northward leaving 17,000 $mi^2$ ($4.4 \times 10^4$ $km^2$) in northwestern Minnesota under water. The water level gradually lowered and the lake ceased to exist about 6000 B.C. It left a northward drainage and today the bog is drained by the Red River of the North and Rainy River - Lake of the Woods drainage basins, both of which empty into Hudson Bay.

The region is not uniform in vegetational composition. While huge tracts are given over to black spruce and tamarack, mixed coniferous-hardwood forests, such as those in Beltrami Island State Forest, thrive on the glacial strandlines, or "beaches", that formed as the glacial lake retreated northward at a non-uniform rate. Over fifty such strandlines in the Big Bog have been identified.[6]

While some relatively shallow depressions in the glacial lake bed remain undrained (e.g., Upper and Lower Red Lake), the broad flat plains are generally marked by few open water bodies. The bog is classified by the U.S. Fish and Wildlife Service as a Type 8 wetland (bog).[10] The use by and importance of this area to wildlife is discussed in Section 3.5.1.

## 3.4 CLIMATE

### 3.4.1 General Influences

North-central Minnesota has a continental climate where outbreaks of polar air are frequent throughout the year. Summers are mild, with periods of warm, sunny days interspersed with rainy or cloudy days caused by slow moving low pressure centers with their attendant frontal systems. Winters are bitter, with below-zero temperatures common. Spring and autumn are transitional seasons, with moderate daytime temperatures and cold nights. The growing season in northern Minnesota is typically from June 1 to September 1. In winter, frost penetrates to depths of 30 to 36 in. (75 to 90 cm).[11,12] Temperatures have ranged from 98°F (37°C) in July, 1975, to -46°F (-43°C) in January, 1968.

### 3.4.2 Winds

The predominant wind direction in the area is westerly, and the wind speeds are moderate. Monthly values of mean and maximum wind speeds for other stations in the region are presented in Table 3.9.[13] High wind speeds are typically associated with thunderstorm activity, but are also common during blizzards conditions in winter.

### 3.4.3 Precipitation

The total average annual precipitation in the region ranges from 20 to 30 in. (50 to 75 cm), with greater than 60% of the annual total falling from May through September.[11,12] The monthly average, maximum, and minimum precipitation is presented in Table 3.10.[11-14] Most of the summer precipitation is derived from thunderstorm activity, while winter precipitation, in the form of snow, is caused by frontal activity preceeding arctic air masses. Maximum snowfall data are presented in Table 3.11. Freezing rain, resulting in heavy accumulations of glaze ice, occurs infrequently in the region.

### 3.4.4 Fog

The annual average number of days with fog reducing visibility to 1/4 mi (0.4 km) or less is 15 days at International Falls.[12] Dense fog may form over warm rivers and move slightly inland, but would be very localized in its effect of reducing visibility. Monthly averages of heavy fog are presented in Table 3.12.[12,13]


Fig. 3.9. Glacial Lakes of Northeastern Minnesota. From A. R. Peterson, Minn. DNR Sp. Publn. No. 107, 1974.

Table 3.9. Monthly Mean and Maximum Wind Speeds (in mph) and Wind Directions for International Falls and Minneapolis, St. Paul

| Month | International Falls[a] | | | | Minneapolis-St. Paul[a] | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean Wind Speed | Direction | Maximum Wind Speed | Direction | Mean Wind Speed | Direction | Maximum Wind Speed | Direction |
| January | 9.2 | W | 32 | SW | 10.4 | NW | 40 | SE |
| February | 9.1 | W | 36 | W | 10.6 | NW | 52 | NW |
| March | 9.5 | W | 42 | W | 11.3 | NW | 47 | E |
| April | 10.5 | NW | 52 | SW | 12.3 | NW | 52 | WSW |
| May | 10.1 | NW | 52 | S | 11.4 | SE | 61 | NW |
| June | 8.7 | SE | 46 | S | 10.5 | SE | 63 | NW |
| July | 8.0 | W | 46 | W | 9.3 | S | 92 | W |
| August | 7.7 | SE | 40 | NW | 9.1 | SE | 63 | N |
| September | 8.8 | SE | 35 | SW | 9.8 | S | 47 | N |
| October | 9.5 | SE | 47 | NW | 10.4 | SE | 73 | S |
| November | 9.9 | W | 35 | W | 11.0 | NW | 60 | SW |
| December | 9.1 | W | 33 | NE | 10.3 | NW | 52 | W |

[a]Local Climatological Data, Annual Summary with Comparative Data, 1976, for International Falls, Minnesota, NOAA, Environmental Data Service, National Climatic Center, Asheville, N.C.

[b]Local Climatological Data, Annual Summary with Comparative Data, 1976, for Minneapolis-St. Paul, Minnesota, NOAA, Environmental Data Service, National Climatic Center, Asheville, N.C.

Table 3.10. Monthly Water-Equivalent Precipitation (in inches)

| Month | International Falls[a] | | | Minneapolis-St. Paul[b] | | | Virginia[c] | Bandette[c] |
|---|---|---|---|---|---|---|---|---|
| | Mean | Maximum | Minimum | Mean | Maximum | Minimum | Mean | Mean |
| January | 0.85 | 3.03 | 0.10 | 0.73 | 3.63 | 0.11 | 0.95 | 0.61 |
| February | 0.71 | 1.81 | 0.19 | 0.84 | 2.07 | 0.06 | 0.69 | 0.59 |
| March | 1.10 | 3.07 | 0.19 | 1.68 | 4.75 | 0.32 | 1.26 | 0.75 |
| April | 1.67 | 3.12 | 0.33 | 2.04 | 5.40 | 0.59 | 2.11 | 1.35 |
| May | 2.75 | 5.89 | 0.20 | 3.37 | 8.03 | 0.61 | 2.90 | 2.08 |
| June | 3.91 | 8.19 | 0.70 | 3.94 | 7.99 | 1.06 | 3.76 | 3.56 |
| July | 3.98 | 9.52 | 1.00 | 3.69 | 7.10 | 0.58 | 3.76 | 3.51 |
| August | 3.39 | 11.26 | 0.97 | 3.05 | 6.60 | 0.43 | 3.78 | 3.32 |
| September | 3.32 | 7.36 | 0.28 | 2.73 | 7.53 | 0.41 | 3.04 | 2.39 |
| October | 1.69 | 4.84 | 0.22 | 1.78 | 5.68 | 0.01 | 1.98 | 1.45 |
| November | 1.30 | 2.89 | 0.10 | 1.20 | 5.15 | 0.02 | 0.76 | 1.17 |
| December | 0.98 | 1.67 | 0.16 | 0.89 | 2.21 | T | 0.92 | 0.63 |
| Annual | 25.65 | | | 25.94 | | | 26.91 | 21.41 |

[a]"Local Climatological Data, Annual Summary with Comparative Data, 1976, for International Falls, Minnesota," NOAA, Environmental Data Service, National Climate Center, Asheville, N.C.

[b]"Local Climetological Data, Annual Summary with Comparative Data, 1976, for Minneapolis-St. Paul Minnesota," NOAA, Environmental Data Service, National Climatic Center, Asheville, N.C.

[c]"Climatography of the United States No. 81-4, Decennial Census of U.S. Climate."

Table 3.11. Maximum Monthly Snowfall (in inches)

| Month | International Falls[a] | Minneapolis-St. Paul[b] |
|---|---|---|
| January | 43.0 | 35.3 |
| February | 25.8 | 26.5 |
| March | 31.5 | 40.0 |
| April | 23.0 | 9.6 |
| May | 13.4 | 3.0 |
| June | 0.3 | 0 |
| July | 0 | 0 |
| August | 0 | 0 |
| September | 1.9 | 1.7 |
| October | 6.9 | 3.7 |
| November | 29.7 | 26.3 |
| December | 22.6 | 33.2 |

[a]"Local Climatological Data, Annual Summary with Comparative Data, 1976, for International Falls, Minnesota, NOAA, Environmental Data Service, National Climatic Center, Asheville, N.C.

[b]"Local Climatological Data, Annual Summary with Comparative Data, 1976, for Minneapolis-St. Paul, Minnesota, NOAA, Environmental Data Service, National Climatic Center, Asheville, N.C.

Table 3.12. Annual Average Number of Days with Fog Reducing Visibility to 1/4 Mile or Less

| Month | International Falls[a] | Minneapolis-St. Paul[b] |
|---|---|---|
| January | 1 | 1 |
| February | 1 | 1 |
| March | 1 | 1 |
| April | 1 | 1 |
| May | 1 | 1 |
| June | 1 | 1 |
| July | 1 | 0 |
| August | 2 | 1 |
| September | 2 | 1 |
| October | 1 | 1 |
| November | 1 | 1 |
| December | 1 | 1 |

[a]"Local Climatological Data, Annual Summary with Comparative Data, 1976, for International Falls, Minnesota, NOAA, Environmental Data Service, National Climatic Center, Asheville, N.C.

[b]"Local Climatological Data Annual Summary with Comparative Data, 1976, for Minneapolis-St. Paul, Minnesota," NOAA, Environmental Data Service, National Climatic Center, Asheville, N.C.

### 3.4.5 Storms

Thunderstorms, with attendant lightning, heavy winds, and rainfall, are frequent, occurring on an average of 31 days per year at International Falls,[12] with hail occurring about two days annually.[11] Tornadoes are infrequent, with a probability of striking a 1° square area (4,767.5 $mi^2$ or 13,616.3 $km^2$) in the region once every 5900 years.[15] Heavy snowfall occurs each winter; if this snow falls before extremely cold temperatures arrive, this blanket of snow insulates the earth, preventing the penetration of the frost and making travel by heavy equipment impossible.

### 3.4.6 Air Quality

Because of the relatively few industrial and residential pollution sources, the present air quality of the region is quite good. Some data have been recorded in the area, and are presented in Table 3.13. The major pollution sources in the area are the mines and associated facilities in the Mesabi formation (ER, pp. 1.3-1.21), in the southeastern part of the region. Pollution sources also include all the limited residential areas within the region, but these sources have only a very local effect. Agricultural exploitation of the area will increase local total suspended particulate levels, as will emissions from vehicles and fugitive emissions from fertilizer and/or pesticide applications.

Table 3.13. Maximum Measured Levels of Total Suspended Particulates and $SO_2$ (in $\mu g/m^3$)

| County[a] | TSP | $SO_2$ |
|---|---|---|
| Beltrami | 30 | 4 |
| Itasca | 21 | - |
| Koochiching | 102 | 4 |
| St. Louis | 72 | 25 |
| Minnesota standards[b] | 150 | 260 |

[a]County Maximum TSP and $SO_2$ Data Set, USEPA.

[b]Minnesota Pollution Control, Chapter 7, Act 7.

## 3.5 BIOTIC RESOURCES

### 3.5.1 Aquatic Environment

#### 3.5.1.1 Streams

Few data are available on the biota of the streams to be crossed by the proposed transmission line. In general, the waters are dark stained, soft, poorly buffered, and have a pH in the range of 5.0-6.0. Most of the streams originate in bogs or drain them somewhere along their course, and in this situation the bottoms consist mostly of muck (ER Supp., Resp. to Q. 15).

The rivers are primarily warm water. There is only one trout stream, the La Vallee (Valley) in the Little Fork watershed, that will be crossed by the proposed line. Fish species typical of the remaining streams to be crossed by the line include the common sucker, several species of redhorse, chubs, northern pike, walleye, dace, shiners, sticklebacks, yellow perch, and small and largemouth bass (ER Supp., Resp. to Q. 15).

Benthological data are available for the Little Fork River from a survey done in 1969.[8] The organisms found in a relatively undisturbed stretch of the river included the following major taxa: Ephemeroptera, Plecoptera, Diptera, Odonata, Trichoptera, Coleoptera, Hemiptera, Lepidoptera, Crustacea, Hydracarina, Annelida, and Mollusca.[8] In the absence of detailed characterizations of the stream biota for those bodies of water to be crossed by the line, the staff will assume that the above taxa are representative.

The Roseau River watershed in the extreme northwestern portion of the line is of special note because it has an unusually large population of northern pike. The riverpools in the Roseau

River Wildlife Management Area are used heavily for spawning by this species, and up to 100,000 fingerlings and larger pike are removed each year for stocking elsewhere in the state.[6]

3.5.1.2 Lakes

All of the lakes potentially affected by the proposed line are shallow, warm water, and eutrophic in character. None support trout populations[16] and most are marginal at best for populations of centrarchids and walleye (ER Supp., Resp. to Q. 22). Most, if not all, of the lakes within one mile (1.6 km) of the proposed route (centerline) harbor year-round fish populations, and those may include walleye, northern pike, largemouth bass, crappie, bullhead, rock bass, minnows, bluegills, and yellow perch. In the absence of lake-specific sampling the staff will assume that this variety of species is typical of the lakes listed in Table 3.8. Based on survey information provided by Peterson,[9] the staff concludes that this is a reasonable assumption.

3.5.1.3 Wetlands

The term "wetlands" refers to lowlands covered by shallow and sometimes temporary or intermittent waters.[10] Within this general definition exist a wide variety of habitat types, including marshes, swamps, bogs, wet meadows, potholes, sloughs, and floodplains. While all of these habitat types exist to some extent in the vicinity of the corridor, by far the dominant habitat type is a well-developed black spruce-tamarack bog. The soil is usually waterlogged and supports a spongy covering of mosses. Such habitat is typical in shallow lake basins, flat uplands, and along sluggish streams. The predominant geological feature resulting in the bog along the corridor is glacial Lake Agassiz.

Wetlands usually support a well-mixed association of terrestrial and aquatic plants and animals. In a bog the biota is shifted furthest towards a terrestrial community. The dominant woody vegetation in the area of the corridor consists of black spruce and tamarack. However, leather leaf, Labrador tea, cranberries, sedges, and cottongrass are also typical of the plant community. Few aquatic animals are present because there is very little open water, and, as one would expect, bogs have the lowest value for waterfowl of all 20 types of wetlands.[10] Of all the wetlands existing in northern Minnesota, less than one-quarter are of primary importance to waterfowl nesting and/or migration activities.[10]

3.5.2 <u>Terrestrial Environment</u>

The area traversed by the proposed transmission line is located within the "Northern Forest Region",[17] the "Coniferous Forest Formation",[18] or simply north-central Minnesota. However, the area may also be considered to be in a transition zone in which the development of vegetation is influenced by floral elements of the boreal forest (to the north), and to a lesser extent by elements of the prairie (to the west) and the deciduous forest (to the southeast). Given the frequently marked correlation between natural plant-animal associations, the fauna of the project area consists of some species that are well adapted to the local environment and others that are at the periphery of their geographic distribution. The foregoing is not intended to portray plant-animal interactions as being of paramount importance, since numerous environmental variables may contribute to or limit animal distributions, but plant-animal interactions will be variously referred to in following discussions.

3.5.2.1 Flora

Marschner's map of "presettlement vegetation" of Minnesota indicates that the principal vegetation type of the proposed project area was spruce-fir, including bog conifer communities (ER, Fig. 1.3-1), with a single outlier of maple-basswood forest in the area. Relatively small tracts of pine forest occurred throughout the area that will be traversed by the proposed transmission line. Numerous other authors of differing disciplines have used various criteria to classify the vegetation of all or portions of Minnesota, some of which are cited in a recent (1977) presentation by Kratz and Jensen.[18] According to these authors, the portion of the project area north of the Koochiching-Itasca county line (Fig. 2.1) is located in the Glacial Lake Agassiz Lowland Section, and that portion to the south is within the St. Louis River Section of the Coniferous Forest Formation.

Kratz and Jensen note that "Marschner indicates that conifer bogs and swamps were the predominant vegetation type" of the Lake Agassiz Section, and that aspen-birch (conifer) and jack pine barrens were major upland vegetation types. Further, the authors recognized Heinselman's vegetation types[19] as characteristic of the section--the types are as follows:

| | |
|---|---|
| Rich swamp forest | Black spruce-feather moss forest |
| Poor swamp forest | Sphagnum-black spruce-leatherleaf bog forest |
| Cedar string bog and fen | Sphagnum-leatherlead-kalmia-spruce heath |
| Larch string bog and fen | |

"Although 11 of Marschner's vegetation types were found" in the St. Louis River Section, Kratz and Jensen ranked the more extensive types as follows: the aspen-birch (conifer), and the conifer bog and swamp types were the most extensive. The white and Norway (red) pine, jack pine barrens, and the mixed hardwood and pine types were of common occurrence.

The applicant has classified and characterized the vegetation of a study area surrounding the designated transmission ROW (ER, Table 1.3-3). The applicant's presentation has not been included herein; however, the information has been summarized and modified to characterize the community types occurring in the designated ROW, as shown in Table 3.14. The areal extent of the various community types occurring within network segments (see Fig. 2.1) of the designated transmission ROW are shown in Table 3.15.

### 3.5.2.2 Fauna

Mammals

The applicant estimates that about 55 species of mammals inhabit the project area (ER, Sec. 1.3.1.2). Species-range maps presented by Burt and Grossenheider indicate the presence of about the same number of species.[20] However, as noted with respect to the local flora, the proximity of the project area to more northern boreal environments is reflected in the composition of local mammal populations, as is exemplified by distribution patterns of the shrews.

The southern distributional limits of the arctic, northern water and pygmy shrews include various portions of Minnesota. The range of the masked shrew includes northern portions of Iowa, but all of the aforementioned species occur extensively in all northerly directions from the project area. In contrast, the distribution of the shorttail shrew is most extensive in southerly and easterly directions. The project area is also within but near the western distributional limits of the starnose mole that occurs extensively northeasterly and southeasterly to the Atlantic coast.[20] The foregoing species occur in a wide variety of habitats; however, the mole and northern water shrew are good swimmers and are strongly associated with aquatic habitats.

All bat species of the project area are wide-ranging mammals with extensive distributions in both the United States and Canada, in some cases extending into Mexico. The silver-haired, red, and hoary bats migrate to the south during autumn or winter seasons, whereas Keen's myotis hibernates during the winter.[20,21] Some big brown bats migrate prior to winter while others hibernate in hibernaculae such as caves, tunnels and hollow trees. "In the north," most little brown bats migrate to the south in winter;[20] however, Long reports that this species "sometimes hibernates" in the Lake Michigan drainage basin.[21]

The black bear is the largest carnivore occurring in the project area, which is within but near the southern range limits of the species in Minnesota. The bear is widely distributed in boreal regions to the north. Other typically boreal species, similarly distributed with respect to the project area, include the lynx, gray wolf, fisher, and marten. Principal habitat preferences of the foregoing carnivores are as follows: black bear and lynx, forest and swamp; gray wolf, forest and tundra; fisher, mixed hardwood forest; and marten, cedar swamps[20] and conifer forests.[21,22] Important species interactions involve the gray wolf, lynx and fisher, which are primary predators of the white-tailed deer, snowshoe hare and porcupine, respectively.[20,22] Other more commonly distributed carnivores strongly associated with aquatic habitats include the river otter, raccoon, least and shorttail weasels, and mink.[20,21,23] The bobcat frequents swamp habitats, and mature forests.

Most of the other carnivores occurring in the project area typically frequent a wide variety of terrestrial habitats. The least selective species include the striped skunk, coyote, red fox and longtail weasel. The spotted skunk and gray fox inhabit somewhat fewer habitat types, and the badger is primarily a prairie species.[20,21] In the project area, the spotted skunk and longtail weasel are at the northern distributional limits for these species.

An estimated 19 species of rodents occur in the project area. This total includes the assumed presence of the Norway rat and house mouse, which are invariably associated with human settlements. It also includes the "fringe" species (i.e., at their limits of distribution) such as the thirteen-lined ground squirrel and prairie pocket gopher that are typically associated with prairie habitat.[20,21]

Table 3.14. Plant Communities within and Adjacent to the Proposed Transmission Right-of-Way, Forbes, Minnesota, to the International Border

| Community Type | Dominant Species | Typical Associated Species |
|---|---|---|
| Spruce-Fir | white spruce<br>balsam fir | white and red pine, white cedar, paper birch, quaking aspen, mountain ash, balsam poplar, beaked hazel, bush honeysuckle, speckled alder, mountain maple, dewberry, bishop's cap, blueberry, bunchberry, bedstraw, clintonia, large leaved aster, goldthread, starflower, sarsaparilla, Canada mayflower. |
| Aspen-Birch | paper birch<br>quaking aspen<br>balsam poplar | Same as for spruce-fir. |
| Pine forest | white pine<br>red pine<br>jack pine | white spruce, balsam fir, white cedar, paper birch, quaking aspen, red maple, northern pin oak, beaked hazel, fly honeysuckle, mountain maple, wintergreen, blueberry, juneberry, sweet fern, sarsaparilla, feather mosses, bedstraw, Canada mayflower. |
| Conifer bogs and swamps | | |
| -Rich swamp forest | white cedar | black ash, black spruce, tamarack, speckled alder, creeping snowberry, sphagnum, starflower, goldthread, twinflower, bunchberry. |
| -Poor swamp forest | tamarack | black spruce, white cedar, bog birch, bunchberry, bog rosemary, leatherleaf, bladderwort. |
| -String bog-fen complexes | white cedar or tamarack | black spruce, bog birch, bog rosemary, sedges, pitcher plant, cottongrass. |
| -Black spruce-feather moss forest | black spruce<br>feather mosses | blueberry species, small cranberry, sphagnum, Labrador tea. |
| Open muskeg or heath | sphagnum, leatherleaf, bog laurel | black spruce, small cranberry, cottongrass, reindeer moss. |
| Northern hardwood or mixed hardwood-pine | sugar maple<br>American basswood | red maple, red oak, American elm, black ash, bur oak, paper birch, balsam fir, white pine, beaked hazel, mountain maple, red berried elder, Canada mayflower, sarsaparilla, twisted stalk, trillium. |
| Wet marsh and open water | bullrush and cattail | arrowhead, common reed, water arum, water parsnip, sweet flag, wild rice, waterlilies, water milfoil, lesser duck weed, pondweeds, sedges, wild iris. |
| Shrub associations | willows, alders | black ash, black spruce, tamarack, creeping snowberry, sphagnum, starflower, goldthread, twinflower, bunchberry, white cedar, bog birch, bog rosemary, bladderwort, sedges, pitcher plant, cottongrass, blueberries, Labrador tea, reindeer moss. |
| Cropland and pasture | agricultural crops and pasture species | common weedy forbs and grasses. |

Table 3.15. Acreages of Various Plant Community Types in the Proposed Transmission Corridor

| Community Type | Transmission Line Segments (see Fig. 2.1) | | | |
|---|---|---|---|---|
| | Network 1[a] | Network 2[b] | Network 3[b] | Network 4[a] |
| Spruce-fir | 85(34)[c] | 433(175) | 57(23) | |
| Aspen-birch | 425(172) | 351(142) | 330(134) | 169(68)[e] |
| Pine forest | 6(2.5) | 17(7) | | |
| Conifer bogs and swamps | | 118(48) | | 367(149) |
| Northern hardwoods | 8(3) | 46(19) | | |
| Marsh and/or open muskeg | 205(83)[d] | 926(375) | 198(80) | 118(48) |
| Shrub associations | | | 118(48) | |
| Agricultural and other | 252(102) | | | 90(36) |

[a]Estimates based on ER, Supp. Response to Questions 23, 24.

[b]Minnesota Environmental Quality Council, Final Environmental Impact Statement.

[c]Figures in parentheses indicate area in hectares.

[d]Indicated as marsh/bog by the applicant.

[e]Indicated as aspen/spruce by the applicant.

Typical forest rodents include the eastern and least chipmunks, the red, eastern gray and northern flying squirrels, the redback vole, and the porcupine. The last mentioned species commonly feeds on inner bark, thus causing death and deformation of forest trees.[20,21] The woodchuck and eastern fox squirrel usually frequent open woods and forest-edge habitats. Characteristic species of aquatic habitats are the beaver and muskrat that feed primarily on woody and herbaceous plants, respectively. Species which inhabit bogs, marshes and wet meadows include the southern bog lemming, meadow vole and meadow jumping mouse. The deer mouse frequents a wide variety of dryland habitats.

Primarily a boreal species, the snowshoe hare typically inhabits swamp forests and thickets--vegetation types that prevail throughout much of the area traversed by the proposed transmission line. In contrast, the project area corresponds with the distributional limits of the white-tailed jackrabbit, primarily a western prairie species, and the eastern cottontail that ranges extensively to the south and east.

The big game animals of the project area are the white-tailed deer and moose. The relatively abundant deer typically inhabit forest-edge environment but utilizes a wide variety of vegetation types. Coniferous forests are important for winter shelter. Early successional stages of forest vegetation (including aspen) and white cedar stands of the swamps are especially important food sources in the project area. Unlike the deer, the less frequently occurring moose is primarily a boreal species and is most abundant in northwestern portions of the project area. The "fringing conifer swamps and aspen-willow brushlands" in this area are ideal habitat for moose (ER, Sec. 1.3.1.2.1.2).

Moyle indicates mammal species "in need of special concern" include the marten, lynx, fisher, gray wolf, rock vole, and bobcat.[22]

## Birds

Green and Janssen have identified 292 species of birds that regularly occur in Minnesota during one or more seasons.[24] Of the total only 27 species are permanent residents; 180 species are summer residents; 22 species are winter residents; and 63 species are migrants. The large number of summer residents and migrants precludes convenient discussion of all species likely to occur in the project area. Thus, the presentation is oriented towards the identification of characteristic species or primary inhabitants of major habitats of the northern coniferous forests. Many of the characteristic species utilize habitats other than the primary habitat identified herein.

Green and Janssen have noted that within the northern coniferous forest regions, the most characteristic species of the boreal forest inhabit the muskeg-black spruce bogs developed on

peatlands of former glacial lakes. In view of the extensive spruce bog habitat traversed by the proposed transmission line, the following species are of particular import.

Spruce grouse
Yellow-bellied flycatcher
Gray jay[a,b]
Boreal chickadee
Hermit thrush
Golden-crowned kinglet[a]
Ruby-crowned kinglet
Solitary vireo
Hawk owl[25]
Nashville warbler
Cape May warbler
Yellow-rumped warbler
Bay-breasted warbler
Palm warbler
Connecticut warbler
Dark-eyed junco
Lincoln's sparrow
Tennessee warbler

Of these species, only the spruce grouse, gray jay, hawk owl and boreal chickadee are permanent residents of Minnesota.

Species commonly associated with wet marsh and open water habitats in the project area include the following:

Black duck
American widgeon
Ring-necked duck
Common goldeneye[b]
Common merganser
Red-breasted merganser
Solitary sandpiper
Bald eagle (northern)
Osprey
Herring gull
Common tern
Alder flycatcher
Northern waterthrush
Rusty blackbird

None of the above species are permanent residents.

Sedge meadows of north central Minnesota are typically inhabited by the following summer-resident species.[24]

Sora
Yellow rail
Short-billed marsh wren
LeConte's sparrow

Species commonly occurring in successional forests (including shrub-fields) and relatively stable forests of the Northern Coniferous Region include the following:

Goshawk
Merlin
Great gray owl
Black-backed three-toed woodpecker
Northern three-toed woodpecker
Olive-sided flycatcher
Common raven[a,b]
Red-breasted nuthatch[a,b]
Winter wren
Swainson's thrush
Philadelphia vireo
Golden-winged warbler
Orange-crowned warbler
Northern-parula (warbler)
Black-throated blue warbler
Magnolia warbler
Black-throated green warbler
Blackburnian warbler
Pine warbler
Mourning warbler
Wilson's warbler
Canada warbler
Evening grosbeak[a,b]
Purple finch[a,b]
Pine siskin[a,b]
Red crossbill[a,b]
White-winged crossbill[b]
White-throated sparrow

Species of this group which are permanent residents include: goshawk, great gray owl, the two woodpeckers, common raven, and the two species of crossbills.

The principal upland game birds of the project area are the ruffed, sharp-tailed and spruce grouse (ER, Sec. 1.3.1.2.1.1). The spruce grouse, a resident of the boreal forest, is not hunted extensively. The ruffed grouse exhibits a strong dietary preference for aspen buds during the winter and spring seasons.[23] The sharp-tailed grouse inhabits open fields near bordering brushlands; the species occurs primarily in northwest portions of the project area, but also occurs in western St. Louis County. The woodcock is most abundant in lowland alder and aspen-willow communities of the southern third of the project area.

Of the probable inhabitants of the project area,[24] Cooper's hawk, marsh hawk, northern bald eagle, double-crested cormorant, Franklins gull and common tern are reported as species of changing or uncertain status by the Minnesota Department of Natural Resources.[22] Similarly, the

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[a]Identified in 1974 Christmas Bird Count, Hibbing, MN.[26]

[b]Identified in 1974 Christmas Bird Count, International Falls, MN.

great blue heron, common loon and pileated woodpecker are reported as species of "special interest."[22]

Reptiles and Amphibians

Species-distribution (ranges) maps presented by Conant indicate that species diversity of reptilian and amphibian populations of the area traversed by the proposed transmission line is relatively low compared to that in areas of similar latitude.[27] The applicant has reported 11 species of amphibians and six species of reptiles in the six counties within the proposed project area (ER Supp., Resp. to Q. 27). Conant[27] indicates the likely presence of a few additional species, and some instances of uncertainty due to discrepancies in nomenclature.

Turtles inhabiting the project area include the common snapping turtle and the western painted turtle. Both species are aquatic turtles that seldom range far from permanent water bodies.[27-29] They are probably most abundant in eastern portions of the project areas (Network I, Fig. 2.1) where the incidence of ponds and lakes is relatively high.

The applicant reports four species of snakes occurring in the project area as follows: the red-bellied snake, the eastern smooth green snake, and the common and red-sided garter snakes. The last mentioned species probably occurs less frequently than the others, since the primary range of the red-sided garter snake is to the west of the project area.[28] Similarly, the southern portion of the project area is within or immediately adjacent to the northern range limits of the eastern hognose snake[27] (not reported by the applicant), and therefore the species is likely to be an infrequently occurring inhabitant of the project area.

The wood frog, mink frog, northern leopard frog, green frog and northern spring peeper are reported by the applicant as occurring in the project area. Conant[27] substantiates the occurrence of these species in all or portions of the project area. Other common frog species of the project area include the western chorus frog, boreal chorus frog, eastern gray tree frog and southern gray tree frog.[27]

Toads reported occurring in the project area include the Manitoba (Canadian) toad and the American toad (ER Supp., Resp. to Q. 27). Suitable habitats of the latter species are widespread; however, the Canadian toad most likely occurs only in the northern portion of the project area.[27]

The central newt and mudpuppy are likely inhabitants since distributional limits of these two species include all or portions of the project area.[27] Similarly, the eastern tiger and blue spotted salamanders[30] are likely to be present.[27,28]

## 3.6 ENDANGERED AND THREATENED SPECIES

### 3.6.1 Aquatic

No aquatic plants or animals classified as threatened or endangered by the USDI Fish and Wildlife Service have been recorded within the proposed corridor, nor does the range of any such designated plant or animal include any portion of the proposed corridor.[31,32] The State of Minnesota has no official list of threatened and/or endangered species, but does have a list of "animals and plants which merit special consideration and management".[22]

Three species--the black redhorse (*Moxostoma duquesnei*), lake sturgeon (*Acipinser fulvescens*), and paddlefish (*Polyodon spathula*)--are listed as being of changing or uncertain status in Minnesota. The populations of those species in Minnesota could increase or decrease, but at present their distribution is uncommon and local. They have the potential of becoming threatened. These are mainly limited to the Mississippi drainage and do not occur in the proposed corridor.

The brook lamprey (*Tampetra lamottei*), blue sucker (*Cycleptus elongatus*), least darter (*Etheostoma microperca*), and pugnose shiner (*Notropis anogenus*) are species that merit special interest in Minnesota because of unusual or unique value, special public interest, or vulnerability of habitat. They are not likely to become threatened or endangered in the near future, but should be watched as important indicators of environmental quality. These species may be found in unpolluted waters along the proposed corridor.

Finally, species which have been extirpated, or nearly so, from Minnesota's aquatic environs include the blackfin cisco (*Coregonus nigropinnis*), blue catfish (*Ictalurus furcatus*), and skipjack herring (*Alosa chrysochloris*). These are species for which there is little hope of reestablishing wild populations in Minnesota because of increases in human populations, changes in land and water use, and gross loss of habitat.[22] These species are limited to the Great Lakes drainage and so are not normally found in the proposed corridor.

### 3.6.2 Terrestrial

Three species of animals on the current Federal list[33-35] of endangered and threatened species are considered potential residents of the proposed transmission line right-of-way. One--the peregrine falcon--would be considered only as a migrant.

The gray wolf (*Canis lupus*) was recently reclassified from endangered to threatened status for northern Minnesota only, while remaining endangered throughout the rest of its range.

The State of Minnesota is the last area within the 48 conterminous states where a major population of the gray wolf remains. This may be primarily due to the remote primary habitat of the population which is composed in large part of protected public lands.

In general, most wolves live in family groups or packs composed of two to eight members. Each pack may range over an area of about 50-120 square miles (130-310 $km^2$) or more and tends to be territorial. The primary prey of the gray wolf includes white-tailed deer, moose, and beaver.[36]

On March 9, 1978, the Department of the Interior ruled on the critical habitat for the wolf (43FR 9607) in northern Minnesota and established five zones within the entire state. Zones 1, 2, and 3 have been designated Critical Habitat for the gray wolf. The proposed transmission line route would cross diagonally, from southeast to northwest, Zone 3 of the wolves critical habitat--part of its primary range (see Fig. 3.10). According to the recovery team for the wolf[36] this northwest section of the primary range contains approximately one wolf per 30 square miles (78 $km^2$). The team also indicated that wolf numbers appear to be increasing in this area, probably as a result of legal protection and adequate prey population to support an increase.

The bald eagle (*Haliaeetus leucocephalus*) was recently listed as threatened for the State of Minnesota. Its summer range within the state is concentrated in the northern half with the most young produced in Chippewa National Forest, Itasca County, just west of the proposed route.[24] Since fish is the preferred and dominant food, the majority of eagles nesting within the state are concentrated near large lakes and rivers.[37] According to Green and Janssen[24] bald eagles have nested in St. Louis, Itasca, Beltrami, and Lake of the Woods Counties in the past. Due to the eagle's protected status the exact location of nests are generally not revealed to the public. However, the Minnesota DNR does keep records on the location of nests and has a policy to restrict power lines to at least one-half mile from a known eagle nest.

The peregrine falcon (*Falco peregrinus*), an endangered species, was once a regular summer resident in Minnesota, but has been extirpated from the state since 1964. Formerly peregrines were known to nest along the bluffs of the Mississippi and upper St. Croix Rivers, along Lake Superior and in the Boundary Waters Canoe Area. No falcons were reported as nesting in any of the counties crossed by the route except possibly the northeast corner of St. Louis County, about 50 miles (80 km) from the proposed route. The staff is unaware of any plans to reintroduce the species to this area of Minnesota.

No plants on the current Federal list of protected species are found in the State of Minnesota.[35]

## 3.7 HISTORIC AND PREHISTORIC CULTURAL RESOURCES

### 3.7.1 Region

Prehistoric and historic resources are known in the six-county region which will be crossed by the transmission corridor. Portions of northern Minnesota which include these counties have been historically important for French explorations, fur trading, logging, early pioneer settlements and iron mining.[38-40] This same area was also occupied prehistorically, although extensive archeological studies appear to have been limited.[41,42] The archeological sequence for Minnesota includes an Early, Middle, and Late Prehistoric Period which ranges in time from before 6000 B.C. to A.D. 1700 and includes Paleo-Indian, Archaic, Woodland, and Mississipian cultural traditions.[42,43] As of 1972, 15 prehistoric sites had been excavated in the six counties to be crossed by the transmission line corridor.[42] The cultural affiliation of these sites includes Archaic and Woodland.

Table 3.16 lists the historic and prehistoric sites in these same counties which have been listed in the "National Register." Historic sites in this table include buildings, bridges, and mines. The prehistoric sites that have been listed are mound locations and petroglyphs. In addition, extensive lists of historic and prehistoric locations have been compiled for some counties.[40-43]

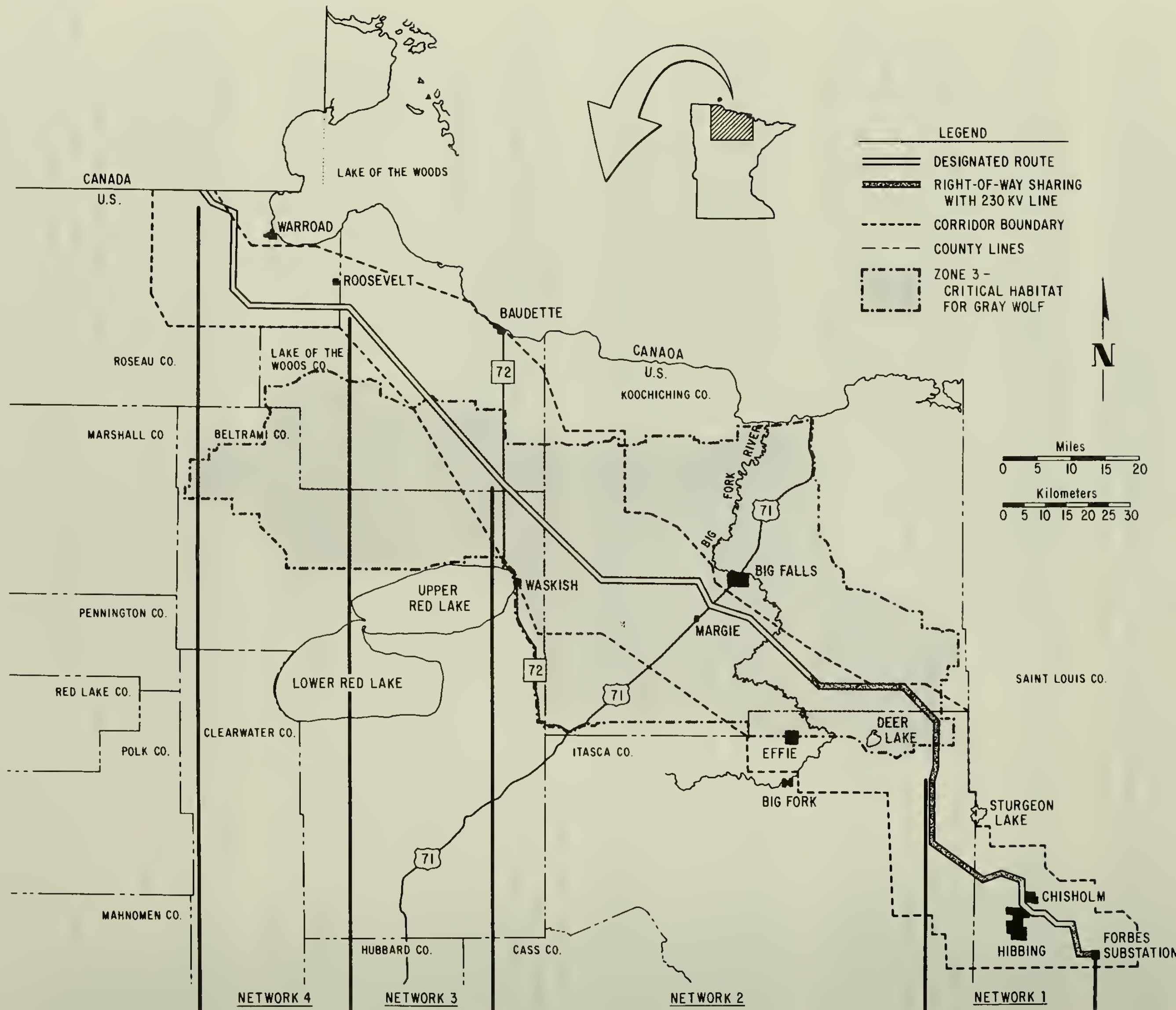


Fig. 3.10. Critical Habitat for Wolves

Table 3.16. Properties Listed in the National Register which Are Located in Counties Crossed by the Transmission Line

| | |
|---|---|
| Beltrami County | St. Louis County |
| Rabideau CCC Camp | Aerial Lift Bridge |
| | Bergetta Moe Bakery |
| Itasca County | Duluth Central High School |
| Old Cut Foot Sioux Ranger Station | Duluth Union Depot |
| Central School | Endion Passenger Depot |
| White Oak Point Site | Fire Department Number One |
| Turtle Oracle Mound | Kitchi Gammi Club |
| | Minnesota Point Lighthouse |
| Koochiching County | Munger Terrace |
| Koochiching County Courthouse | Traphagen, Oliver G. House |
| Gold mine sites | Hull-Rust, Mahoning Open Pit Iron Mine |
| Little American Mine | Longyear, E. J. First |
| Laurel Mounds | Diamond Drill Site |
| Nett Lake Petroglyph Site | Mountain Iron Mine |
| | Kettle Falls Hotel |
| Lake of the Woods County | Soundan Iron Mine |
| Northwest Point | |
| | Roseau County |
| | None |

### 3.7.2 Transmission Corridor

A cultural resource survey for prehistoric and historic sites has not been made in the transmission corridor. However, cultural resources have been located in another transmission corridor which parallels portions of the proposed corridor.[44] These resources include early trails and roads, early logging camps, historic structures, a prehistoric camp, and a historic/protohistoric Indian burial site.[44] Therefore, it seems likely that these same kinds of resource and others may also occur along the proposed NSP corridor.

## 3.8 REGIONAL POPULATION DISTRIBUTION AND SOCIAL PROFILE

### 3.8.1 Demography of the Area

#### 3.8.1.1 General Characteristics

Figure 3.1 presents the area within approximately 50 mi (80 km) from the proposed transmission line. This area includes part of six counties in north-central Minnesota. Table 3.17 lists the 1970 population of the six counties and the projections for 1980, 1990, and 2000.[45,46] With the exception of the city of Duluth, which lies about 50 miles south of the Forbes area, there are no other urban concentrations greater than 25,000 people within 50 miles (80 km) of the transmission line.

#### 3.8.1.2 Growth Dynamics

Table 3.17 presents information on the regional growth dynamics of the counties that are within the 50-mile (80-km) zone.[45] The population size in all the counties except Beltrami declined between 1960 and 1970, with Beltrami experiencing a 12.6% increase during the same time.[47] The future populations in the 50-mile (80-km) zone are projected to increase by about 25-40% in Beltrami,[46,48] to remain the same or show a slight increase in Itasca, Koochiching, Lake of the Woods, and Roseau, while St. Louis is expected to fall about five percent.[46] Most of the increase is expected in the area between 30 and 50 miles (48-80 km) from the line around the city of Bemidji, whereas the population increase close to the line is expected to be small, if any.

### 3.8.2 Community Characteristics

This discussion of community characteristics is presented in terms of settlement pattern and social, economic, and political organizations. It will center on the four separate network areas indicated in Figure 2.1. These areas were selected for more intensive study because they will probably receive the most direct impacts of the transmission line construction and operation.

Table 3.17. 1970 Populations and Projected Populations for the Six-County Area along the Proposed Tranmission Line Route[a]

| County | 1960-1970 Population Change | 1970 Population | 1980 Estimate | 1990 Estimate | 2000 Estimate |
|---|---|---|---|---|---|
| Beltrami | +2,948 | 26,373 | 30,200 | 34,300 | 37,900 |
| Itasca | -2,476 | 35,530 | 36,600 | 37,700 | 36,400 |
| Koochiching | -1,059 | 17,131 | 17,800 | 18,400 | 17,800 |
| Lake of the Woods | -317 | 3,987 | 4,200 | 4,300 | 4,200 |
| Roseau | -585 | 11,567 | 12,100 | 12,700 | 12,800 |
| St. Louis | -10,895 | 220,693 | 217,100 | 215,000 | 210,000 |

[a]From "County and City Data Book, 1972," U. S. Dept. of Commerce, "Minnesota Population Projections: 1970-2000," Minnesota State Planning Agency, 1975, and "Pocket Data Book, 1975," State Planning Agency.

Base data presented in this section are derived from local and state agencies and 1970 census information.

### 3.8.2.1 Settlement Pattern

The settlement pattern throughout the 50-mile (80 km) zone is predominantly rural with dispersed farmsteads, although small population concentrations may be identified as the towns of Warroad, Williams, Big Falls, Washkish, and Effie, which are in Networks 2, 3, and 4. In Network 1, the majority of the population is concentrated within the towns of Hibbing and Chisholm, as well as Mountain Iron, Virginia and Eveleth. Table 3.18 provides information on the populations of these settlements in 1970 and the estimated population for 1976. With few exceptions, the numbers of people living in these settlements appear to be stable or declining; only a few towns are projected to experience substantial growth. At least three-quarters of the 1970 residents of Itasca, Koochiching, Lake of the Woods, Roseau, and St. Louis Counties had resided in the same county for at least five years. The majority of homes in the project area were owner-occupied in 1970, ranging from 74% to 84%.[49]

Numerous commercial-industrial areas are located near the urban centers and are more thoroughly discussed in Section 3.8.2.3. However, some scattered businesses are also found along the major highways. Railroads, airports, and major highways are also located along the proposed route.

### 3.8.2.2 Social Organization

Within the six-county area, the average 1970 household included 3.3 members.[45] This pattern combined with county census data suggests that most households were composed of families that include children and both parents. Because the population and area of residence in the project area (see Secs. 3.8.1 and 3.8.2.1) appear to be relatively stable, interpersonal relationships and kinship are an important part of the social organization in some local settlements. These characteristics may be of particular importance in the organization of the smaller rural towns.

### 3.8.2.3 Industrial Organization

The economic base for the six-county area has shifted away from agriculture. Within the area, less than 18% of the total number of people employed in 1970 were still involved in agriculture. The higher percentage of agricultural employment was located in Network 3 and 4.[49] The major employment category varies throughout the six counties. In St. Louis County, almost 45% of the workforce are white collar workers (professional, managerial, and sales and clerical). In Beltrami and Itasca Counties, the major employment category is government (37.2% and 24.1%, respectively) with professional, managerial and wholesale and retail trade following closely in percent employed. Both in Koochiching and Roseau Counties, the majority of workers are employed in manufacturing (40.5 and 24.5%). This may be due to the pulp and paper industry established within this county. The major employers of Lake of the Woods County are professional, managerial (26.1%) and government (25.5%).[45]

Table 3.18. Population Size in Settlements of the Six-County Area[a]

| County | Town | 1970 Population | 1976 Estimate |
|---|---|---|---|
| Beltrami | Bemidji | 11,490 | 11,415 |
| | Blackduck | 595 | 765 |
| | Funkley | 19 | 21 |
| | Kelliher | 289 | 309 |
| | Tenstrike | 139 | 225 |
| | Turtle River | 50 | 51 |
| | Washkish | 138 | 200 |
| Itasca | Big Fork | 399 | 493 |
| | Cooley | 33 | NA |
| | Effie | 165 | 184 |
| | Keewatin | 1,382 | 1,479 |
| | Nashwauk | 1,341 | 1,350 |
| Koochiching | Big Falls | 534 | 544 |
| | International Falls | 6,439 | 5,970 |
| | Little Fork | 824 | 808 |
| | Mizpah | 118 | 94 |
| | Northhome | 351 | 276 |
| | S. Int'l Falls | 2,116 | 2,489 |
| Lake of the Woods | Baudette | 1,547 | 1,347 |
| | Williams | 220 | 257 |
| Roseau | Roosevelt | 104 | 130 |
| | Roseau | 2,552 | 2,439 |
| | Warroad | 1,086 | 1,295 |
| St. Louis | Buhl | 1,303 | 1,366 |
| | Chisholm | 5,913 | 6,105 |
| | Franklin | 41 | 36 |
| | Hibbing | 16,104 | 16,126 |
| | Iron Junction | 150 | 133 |
| | Kinney | 325 | 457 |
| | Mountain Iron | 3,281 | 3,756 |
| | Virginia | 12,450 | 11,728 |

[a]From "Pocket Data Book, 1975," Minnesota State Planning Agency, and "Estimate of Population of Subcounty Areas," U.S. Dept. of Commerce.

The major industries in the six-county area are centered near the county seats of Roseau, Baudette, Bemidji, International Falls, and Grand Rapids and those of the Hibbing, Chisolm, Virginia area and are listed in Table 3.19.[50] Also included in this table are numbers of employees and union status, where available. Industries associated with lumber and iron ore or taconite mining are dominant. In addition to these major industries, many small businesses are located in and around the larger towns which are along the proposed route.

In 1977, the annual average employment in the six-county area was 126,613 persons, as shown in Table 3.20. Unemployment ranged from 7.3% to 10.1% of the available labor force. All of the counties had a higher unemployment rate than the Minnesota state average of 5.1%.[51]

In 1970, the majority of the employed labor force in the six-county area worked in the county of residence: Beltrami (93.8%), Itasca (87.2%), Koochiching (96.5%), Lake of the Woods (94.2%), Roseau (96.8%), and St. Louis (95.3%).[45] The average median family income in 1970 and for the six-county area was $7,668 ranging from $6,053 in Lake of the Woods County to $8,994 in St. Louis County.[45]

In general, family incomes were higher along the southern part of the route, but within the entire project area, they were below the median income for the State of Minnesota ($9,928).[45]

Table 3.19. Major Employers Near the County Seats and Other Large Towns of the Six-County Area[a]

| Employment Category | Product/Service | Total Employees | Union Affiliation | City |
|---|---|---|---|---|
| Mining | | | | |
| U.S. Steel Corp. | Iron Ore/Taconite | 4,000 | USWA | Virginia |
| J & L Steel Corp. | Iron Ore | 500 | USWA | Virginia |
| Hanna Mining Co. | Iron Ore/Taconite | 1,789 | USWA | Hibbing |
| U.S. Steel Corp. | Iron Ore/Taconite | 239 | USWA | Hibbing |
| Rhude & Fryberger | Iron Ore | 150 | None | Hibbing |
| Hibbing Taconite Co. | Taconite | 816 | USWA | Hibbing |
| U.S. Steel Corp. | Iron Ore | 463 | USWA | Chisholm |
| Jones and Laughlin Steel | Iron Ore | 360 | Local USW | Chisholm |
| Northern Mining Equipment Co. | Mining Equipment | 55 | None | Hibbing |
| Lumber and Paper | | | | |
| Mesabi Daily News | Printing | 70 | None | Virginia |
| W. A. Fisher Co. | Printing | 25 | Typographical | Virginia |
| Publishers Paper | Chipboard | 50 | IBA | Virginia |
| Maturi Brothers Timber Co. | Timber Products | 25 | None | Chisholm |
| Blandin Paper Co. | Coated Paper | 1,100 | IVPMW | Grand Rapids |
| Northprint Co. | Printing | 59 | ITU & IPGCU | Grand Rapids |
| Blandin Wood Products | Waferboard | 124 | Local C & I of Am. | Grand Rapids |
| Chief Products | Pool Tables | 30 | None | Grand Rapids |
| Cole Forest Products | Snow Fencing | 50 | None | Grand Rapids |
| Nu-Ply Corp. | Hardboard | 95 | IWWA | Bemidji |
| Dickinson Lumber | Pulpwood, Lumber | 20-30 | None | Bemidji |
| Corcoran Timber Co. | Wood Fiber Chips | 12 | None | Bemidji |
| Boise Cascade Corp. | Paper and Building Products | 2,000 | AFL-CIO | International Falls |
| Green Forest Products | Sawmill | 25 | None | Littlefork |
| Other | | | | |
| Cluett Peabody Co., Inc. | Garments | 375 | ACWA | Virginia |
| Daily Journal | Newspaper | 29 | ITU | International Falls |
| Staver Foundry | Castings | 90 | AFL-Foundry | Virginia |
| Lambert Industries, Inc. | Heaters | 20 | None | Virginia |
| Mesabi Drill & Tool, Inc. | Twist Drills | 70 | None | Chisholm |
| Boubon & Russ | Excavating and Masonry | 30 | None | Chisholm |
| All State Lawn Products | Cut, Sew, and Assembly | 170 | NAA | Chisholm |
| United Wild Rice Co. | Wild Rice | 30 | None | Grand Rapids |
| Abe W. Mathews Engr. Co. | Ind. and Comm. Equipment | 250 | None | Hibbing |
| L & M Radiator | Radiator Cores | 85 | None | Hibbing |
| J & J Industries | Metal Casting-Brake Linings | 57 | None | Hibbing |
| Northern Ductile | Iron Casting-Brake Linings | 75 | IMAW | Hibbing |
| Irathane Systems | Elastomeric poly. castings, molded | 30 | UAW | Hibbing |
| Am. Linen Co. | Linen Service | 85 | None | Hibbing |
| Polaris Industries Inc. | Snowmobiles | 530 | AFL-CIO | Roseau |
| Roseau Diesel | Long Distance Hauling | 34 | None | Roseau |
| Roseau Children's Home | Health Care | 44 | None | Roseau |
| O.K. Machine Co. | Farm Equipment Plumbing | 25 | None | Roseau |
| Northrup King & Co. | Grass Seeds | 13 | IW | Roseau |
| Citizens State Bank | Bank | 23 | None | Roseau |
| Roseau Hospital | Nursing Care | 167 | None | Roseau |
| Roseau Farm Service | Farm Equipment | 14 | None | Roseau |
| Baudette Air Force Base | Military | 160 | None | Baudette |
| Rowell Lab | Pharmaceutical | 70 | None | Baudette |
| Bemidji Public Schools | Education | 550 | Varied | Bemidji |
| Bemidji State University | Education | 550 | IFOMEA AFSCME | Bemidji |
| Thorson, Inc. | Road Construction | 18-150 | Team | Bemidji |
| Core Craft | Fiberglass Canoes | 15-20 | None | Bemidji |
| Northern Central Door Co. | Overhead Garage Doors | 13 | None | Bemidji |
| Bemidji Woolen Mills | Wood Processing | 15 | None | Bemidji |
| Ric Jig Tackle, Inc. | Fishing Lures | 60 | None | International Falls |
| Holiday Inn | Motel | 80 | M & W | International Falls |
| Rex Hotel | Hotel | 45 | M & W | International Falls |
| Continental Telephone Co. | Telephone | 25 | None | International Falls |
| Paul A. Laurence Co. | Construction | 4-74 | -- | International Falls |

[a]From "International Falls, Bemiddji, Baudette, Roseau, Grand Rapids, Chisholm, Hibbing and Virginia Community Profiles," Minn. Dept. of Economic Development.

Table 3.20. 1977 County Employment Characteristics (annual averages)[a]

| Characteristic | County | | | | | |
|---|---|---|---|---|---|---|
| | Beltrami | Itasca | Koochiching | Lake of the Woods | Roseau | St. Louis |
| Labor Force | 12,798 | 17,527 | 7,661 | 1,854 | 5,490 | 92,756 |
| Employment | 11,861 | 15,763 | 7,118 | 1,715 | 4,924 | 85,232 |
| Unemployment | 937 | 1,764 | 543 | 139 | 566 | 7,524 |
| Unemployment Rate | 7.3% | 10.1% | 7.1% | 7.5% | 10.3% | 8.1% |

Six-County Labor Force - 138,086
Six-County 1977 Employment - 126,613
Six County Unemployed - 11,473

[a]From "Minnesota County Labor Estimates," Minnesota Department of Employment Services, 1978.

### 3.8.2.4 Political Organization

The population of the proposed route is located entirely within the political jurisdiction of the State of Minnesota. The people in this area expected to receive the majority of the impacts are located in Beltrami, Itasca, Koochiching, Lake of the Woods, Roseau, and St. Louis Counties. These counties have a county board of commissioners form of government. County governments are responsible for maintaining roads, schools, hospitals, and other services. All of the counties fall in one of three state regional development commissions (as indicated in Table 3.21), and two of the counties have either a planning office or a county planner (St. Louis Co. and Lake of the Woods Co., respectively).

Table 3.21. Planning Commissions and Local Regulations in the Six-County Area[a]

| Governing Body | Planning Commission | Zoning Ordnance | Subdivision Regulations | Mobile Home Regulations |
|---|---|---|---|---|
| Beltrami County | Yes[a] | No | Yes | ? |
| Itasca County | Yes[b] | Yes | Yes | Yes |
| Big Fork | -- | No | -- | -- |
| Effie | -- | No | -- | -- |
| Cooley | -- | No | -- | -- |
| Keewatin | -- | No | -- | -- |
| Nashwauk | -- | No | -- | -- |
| Koochiching County | Yes[b] | Yes | Yes | Yes |
| Big Falls | -- | No | -- | -- |
| Littlefork | -- | No | -- | -- |
| International Falls | -- | Yes | ? | ? |
| Mizpah | -- | No | -- | -- |
| Northome | -- | No | -- | -- |
| S. International Falls | -- | Yes | ? | ? |
| Lake of the Woods County | Yes[c] | No | No | No |
| Baudette | -- | ? | -- | -- |
| Williams | -- | ? | -- | -- |
| Roseau County | Yes[d] | No | No | No |
| Roosevelt | -- | ? | -- | -- |
| Roseau | -- | ? | -- | -- |
| Warroad | -- | ? | -- | -- |
| St. Louis County | Yes[b] | Yes | Yes | ? |
| Buhl | -- | ? | -- | -- |
| Chisholm | -- | Yes | -- | -- |
| Franklin | -- | No | -- | -- |
| Hibbing | -- | Yes | -- | -- |
| Iron Junction | -- | No | -- | -- |
| Kinney | -- | No | -- | -- |
| Mountain Iron | -- | Yes | -- | -- |
| Virginia | -- | ? | -- | -- |

[a]Derived from R. Snyder, J. Jannetta, and W. Schauble, "Organizational Arrangements for County Planning," Special Rept. 48, Agriculture Ext. Service, Univ. of Minn., 1976; R. Snyder et al., "Land Use Controls by Minnesota Counties," Ext. Folder 291, Agriculture Ext. Service, 1976; and Letter from Steve Krmpotich, Arrowhead Regional Development Commission, Duluth, MN, to Kathie Hoekstra, Argonne National Laboratory, Argonne, IL, 3 April 1978.

[b]Arrowhead Regional Development Commission.

[c]Headwaters Regional Development Commission.

[d]Northwest Regional Development Commission.

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# 4. ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT

## 4.1 IMPACTS ON THE LAND AND LAND USE

### 4.1.1 Geology

The bedrock in the area to be traversed by the transmission line is Precambrian metamorphic rocks, including a two-mile wide belt of "iron-formation" near Hibbing.[1,2] The transmission line is not expected to interfere with existing iron mining operations because the mining companies have cooperated on the right-of-way alignment route.[3]

The impacts on surficial geologic deposits are expected to be minimal. Peat is not presently mined in this area but is a potential energy source. Because the peat deposits extend over a vast area of northern Minnesota, the transmission line will not interfere with the general exploitation of this resource.

Impacts due to geologic processes, including earthquakes, landslides, and stream erosion, are expected to be minimal. The area is not seismically active. Construction involves no large land disturbance. Winter work (70%) will minimize erosion.

### 4.1.2 Soils

#### 4.1.2.1 Construction Effects

The areal extent and severity of soil disturbance resulting from project construction activities will be strongly influenced by the extent that right-of-way clearing and tower-foundation construction is accomplished during the winter season. During a field inspection trip (February 1978), the staff observed winter ROW clearing and tower-base construction in terrain somewhat similar to that of the project area. The minimal soil disturbance associated with the observed activities was impressive.

The applicant has indicated that about 70 percent of the proposed transmission ROW will be cleared during the two winter seasons of the construction period (ER Supp., Resp. to Q. 25). Further noted, however, was that the extent of winter clearing will be contingent on the time period during which the frozen surface will support ROW clearing equipment. The land surface within segments of the ROW selected for winter clearing are predominately organic (peat) and poorly drained mineral soils (see Sec. 3.2.1). In the event that a mild winter limits soil frost formation or otherwise causes a shortening of the winter clearing period, more summer clearing will be necessary. The applicant will "probably upgrade existing skidding trails, forest logging roads and ditch grades" to maximize points of access to the ROW. Where feasible access is not available, access roads will be constructed within the ROW to facilitate clearing in either or both directions from points of existing access (ER Supp., Resp. to Q. 28). In view of the unstable character of surface soils along the route, soil disturbance resulting from the construction activities is expected to be severe.

The north-south segment of the ROW immediately west of Warroad and a contiguous 17-mile (27 km) segment that extends easterly through Roseau County (see Fig. 2.1) is scheduled for warm season clearance (ER Supp., Resp. to Q. 25). Access to the ROW is relatively good; thus soil disturbances will be essentially limited to the ROW. About 12 percent of this portion of the ROW consists of agricultural cropland; however, the remainder is generally poorly drained and clearing operations can be expected to cause severe, local disturbance of surface mineral and organic soils.

The 14-mile (38 km) segment of ROW extending northwesterly from the Forbes substation through the Hibbings area is likewise scheduled to be cleared during the warm seasons. Access areas are generally well drained (see Network 1, Sec. 3.2.1) and upland forest types are more extensive than lowland communities. Clearing of the lowland portions of the ROW will severely disturb soils. In general, clearing of upland vegetation is expected to cause more moderate disturbance of soils. Exceptions will be those instances that involve clearing steep slopes of the rough terrain occurring in this area, thus increasing the erosion potential of affected areas.

While clearing in lowland areas causes severe soil disturbance, the generally moist conditions of surface materials and the limited relief in the area precludes a serious erosion hazard. Areas adjacent to waterways will be selectively cleared to minimize soil impacts (ER, Sec. 2.1.4.3.1).

Based on the optimal spacing, the project will require construction of about 800 towers (ER, Sec. 2.1.2.3); about 20 percent of the towers will be self-supporting steel structures and about 80 percent will be guyed aluminum structures. The foundation for the latter structure will consist of a helix screw anchor assembly (see Fig. 2.5); thus no soil excavations will be necessary. Additionally, the preassembled tower will be transported to the tower site and emplaced by helicopter; thus soil impacts will be primarily limited to compaction and surface disturbance caused by movement of the tracked or rubber tired vehicle used to insert the screw anchor foundations. During winter construction, such activity would have a negligible effect on soils. Construction in other seasons will result in greatly accelerated erosion rates and enhanced soil disturbance.

Materials for the self-supporting steel towers will be hauled to the site and assembled. In some instances, the area to be used as a tower base will have to be leveled and up to 0.5 acre (0.2 ha) of land may be severely disturbed. In any event, the yarding area required for assembling the tower will require about the same amount of space (ER, Sec. 2.1.4.3.3). As indicated by the applicant (ER, Fig. 2.1-4), tower foundation specifications are variable. The volume of soil excavated during foundation construction will range from 21 to 87 cubic yards (16-66 $m^3$) per tower. The excavated material will be subsequently graded evenly around the site or hauled away (ER, Sec. 2.1.4.3.2).

Soils of access routes and the ROW will be further compacted and otherwise disturbed during "conductor stringing" activities. The operation will entail equipment set-ups at successive two- to four-mile (3-6 km) intervals throughout the ROW. In total, the soil impacts resulting from winter construction will likely be of a minor nature; however, those incurred during warm-season construction may be so severe as to warrant altering or rescheduling certain construction activities.

The Minnesota Environmental Quality Board has promulgated several requirements for the applicant with respect to project-related soil disturbances, summarized as follows.[4]

1. If erosion potential exists as the result of severe ground disturbance caused by clearing or line construction, the affected area shall be seeded as necessary with plant species that will most rapidly control erosion.

2. Access and service roads shall be maintained to control soil erosion.

3. Movement of heavy equipment in cropland shall be kept to a minimum and compacted soil shall be restored as near to its original condition as possible.

4. Topsoil of tower foundation sites located in cropland shall be removed, stockpiled during, and replaced following construction activities, and seeded if so designated in conditions of easement. Subsoil materials shall not be spread on adjacent croplands unless approved by the landowner.

5. Disturbed stream banks shall be stabilized and immediately reclaimed to prevent unnecessary erosion.

#### 4.1.2.2 Operational Effects

Following construction cleanup and as necessary, disturbed portions of the ROW and temporary access roads of no future utility will be graded to restore natural ground surfaces (ER, Sec. 2.1.5). The graded surfaces will be seeded with appropriate plant species in accord with easement agreements (if any) and compatibility with safe operation of the transmission line. The objective of such activities is to stabilize the disturbed areas and minimize erosion.

In the event that natural (tornadoes, ice storms, etc.) or man-induced (vandalism) phenomena cause extensive structural damage to the transmission line, various kinds and numbers of heavy equipment will be required to repair the facility. The areal extent and intensity of soil disturbance will be primarily dependent on the length of damaged line, access availability, and the nature and condition of affected soils. However, routine activities associated with line operation will likely have only minor adverse effects on soils. Annual onsite inspection of towers will be accomplished either on foot or by truck or snowmobile (ER Supp., Resp. to Q. 26). At three to five year intervals, boom trucks normally associated with tree trimming and truck-mounted sprayers will be used to control vegetation in the ROW. If properly scheduled and supervised, such activities will likely cause only minor soil disturbances.

### 4.1.3 Agriculture and Forestry

During construction about 4335 acres (1754 ha) of the proposed right-of-way will be disturbed. Only about 3% or about 135 acres (55 ha) of the ROW is considered to be agricultural land, including cultivated and pasture land. Since the centerline of the proposed route has not yet been selected, neither the applicant nor the staff can determine the exact kind or value of crops or livestock presently being produced on land within the right-of-way. However, production will only be lost for one year at the most during construction and is expected to return to near normal thereafter. Figure 4.1 characterizes the potential for high and medium agricultural productivity for this area of Minnesota. Most of the land within the right-of-way has low productivity potential as agricultural land; therefore, the loss is considered to be minimal.

A total of 2430 acres (983 ha) of forested land will be cleared, of which 1340 acres (542 ha) are in either aspen or spruce. Figure 4.2 characterizes the potential for high and medium productivity for forest growth. As with agricultural productivity, the potential for most lands is relatively low in comparison to western and southern portions of Minnesota.

The applicant has committed to making a serious effort to having the trees that are cut salvaged, rather than burned. But in many areas, accessibility problems make it economically unfeasible for the timber to be saved. Since the centerline has yet to be established, the value of timber and the quantity that will be salvaged and that which will be burned cannot be determined.

As discussed in Section 3.1.1, most of the land within the right-of-way will be state-owned, with most located in one of the four state forests. However, even if the assumption is made that *all* forested lands crossed by the right-of-way are within state forests, the loss would only equal less than one-tenth of one percent of all state forest lands. It should be recognized, however, that this loss of land for timber production is a permanent one unless the transmission lines are removed sometime in the future.

## 4.2 IMPACTS ON WATER USE

### 4.2.1 Construction Effects

None of the streams to be crossed by the proposed line serves as a source of municipal-industrial service water; thus no impact is anticipated in this regard. Short-term impacts typically encountered when spanning streams during construction include temporary diversion of use for fishing, canoeing or boating, and esthetic recreation. It appears that no structures or facilities will be erected within a 100-year floodplain.

The proposed route does not cross directly over any lakes, so water use in this case is not a factor.

Wetlands (bog) are the major aquatic habitat type crossed by the proposed transmission line. These desolate bogs have few human settlements and a low habitat value for wildlife including waterfowl.

This lack of impact was a prime consideration in the selection of the proposed corridor, even though access is generally poor. No severe construction impacts on the use of any aquatic system are expected due to careful route selection by parties concerned in the matter (see Sec. 8.2).

### 4.2.2 Operational Effects

No adverse impacts on groundwater due to operation of the transmission line are expected. Possible spraying of herbicides along the right-of-way could contaminate surface water supplies, but the applicant has agreed to include buffer areas of 300-400 feet (91.4-121.9 meters) around all water areas.[5,6] The staff requires that spraying within 100 meters of any body of water be limited to hand application only.

Impacts after construction are limited to esthetic considerations where the line crosses streams and rivers or passes within sight of lakes. Because operation of the line is a "passive" activity, no other impacts are anticipated.

## 4.3 IMPACTS ON AIR QUALITY

### 4.3.1 Construction Impacts

Because the clearing of the right-of-way and the construction of the transmission line will take place during winter over frozen and snow-covered terrain, the fugitive dust problems normally associated with construction activities will not occur. Heavy equipment operating along the

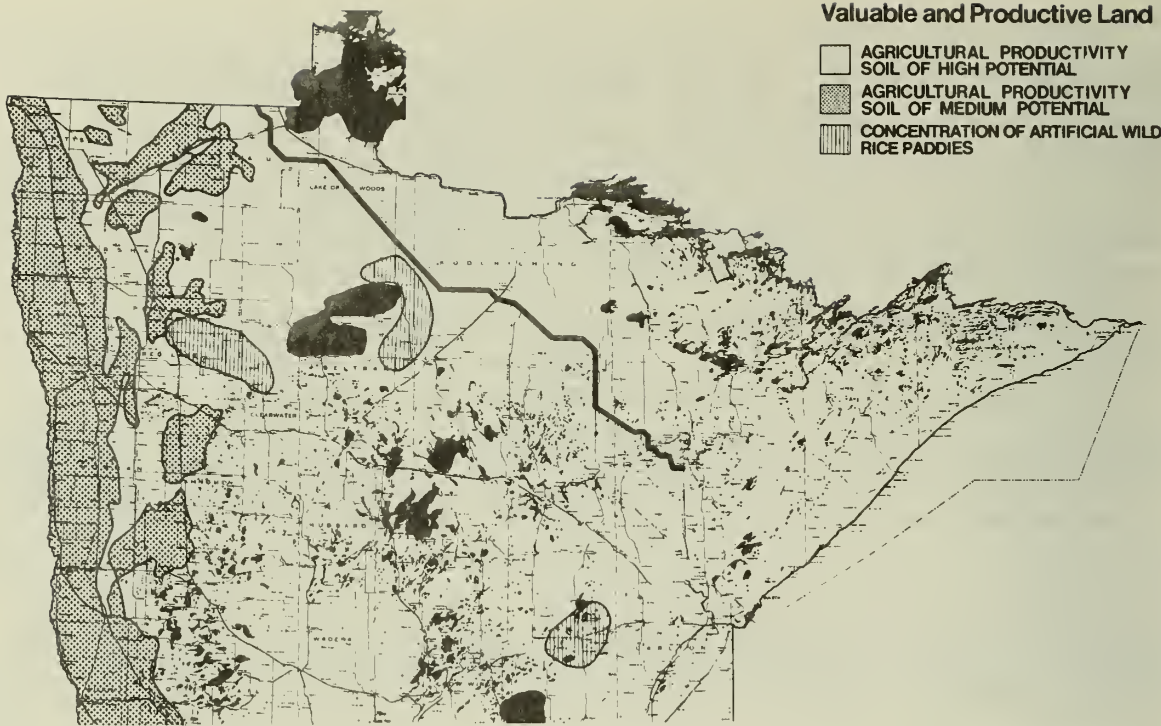


Fig. 4.1. Potential for Agricultural Productivity of the Soils. From "Power Plant Siting Program," Minnesota Environmental Quality Council. Diagonal line shows proposed transmission route.

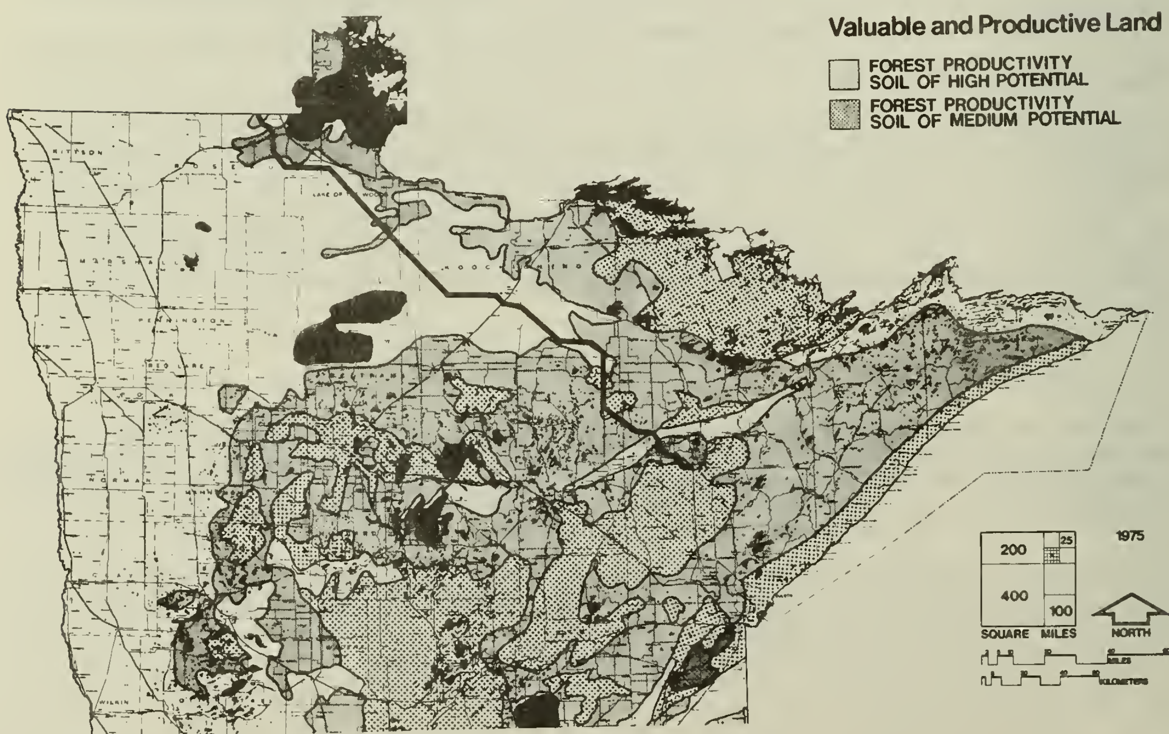


Fig. 4.2. Potential for Forest Productivity of the Soils. From "Power Plant Siting Program," Minnesota Environmental Quality Council. Diagonal line shows proposed transmission route.

right-of-way will generate unburned hydrocarbons, oxides of sulfur, and oxides of nitrogen. Concentrations of these emissions are not expected to approach applicable state and Federal standards. When slash and excess timber are burned, increases in suspended particulates will occur from both combustion and ash resuspension, but it is the opinion of the staff that these increases will be of short duration and very localized, with no lasting adverse impacts.

### 4.3.2 Operational Impacts

The operation of a 500-kV transmission line will create ozone. In the New York Public Service Commission Hearings (Cases 26529 and 26559),[7] the conclusion was that the ozone produced by a 765-kV line would be so slight as to have no significant biological effect. These results indicate that a 500-kV line which produces less ozone than a 765-kV line will have no significant biological effects. Near a 500-kV line a corona, or a breakdown of air in the vicinity of the line, may occur. This effect is most noticeable during periods of rain and fog,[7] and will result in some audible noise as well as radio and TV interference. Findings in Public Hearings state:[8]

> "That generally, radio and television interference is not a significant problem with 500 kV lines. When interference does occur, it is electromagnetic interference. Most radio and television interference that does occur, will occur in the proximity of a 500 kV line when the receiver is far removed from the transmitter and usually during foul weather conditions. Generally, television interference can be lessened by relocating the reception antenna or by extending an existing TV cable system. The applicant assumes the responsibility for remedial action in the event television interference is experienced because of the 500 kV line (Tr. pp. 56-66, June 17, 1976)."

The impacts upon the air quality of the region associated with the operation of the 500-kV line will be localized and minimal.

## 4.4 IMPACTS ON BIOTA

### 4.4.1 Construction Impacts

#### 4.4.1.1 Flora

In general, the vegetation of the inner 180 feet (55 m) of the proposed 200-foot (61-meter) transmission line right-of-way (ROW) will be clear-cut (severed at or near ground level). The outer 10 feet (3 m) within the boundaries of the ROW will be selectively cleared, i.e., existing and potentially tall trees that are hazardous to physical structures or that could interfere with line transmission will be removed. Species of marginal utility as wildlife food and cover habitat will also be removed (ER, App. A, Sec. 1). In some instances, actual or potential "danger trees" standing outside of the ROW boundary will also be felled. As exception to the foregoing, the applicant has negotiated ROW sharing whereby segments of the proposed line will parallel existing transmission lines for a total of about 60 miles (96 km) (ER Supp., Resp. to Q. 29). In such cases, a 150-foot (46-m) width of the ROW will be clear-cut (ER, Sec. 2.1.4.3.1).

It should be noted that clear-cutting will not be necessary throughout the entire ROW. Acreages of the various plant community types occurring in the Network segments of the ROW are summarized in Table 3.15. In those portions of the ROW where low growing trees and shrubs occur (i.e., conifer bogs and swamps, and shrub-associations), clear-cutting will be limited to about the central one-third of the ROW (ER, Sec. 2.1.4.3.1). No clear-cutting will be necessary where the vegetation consists of lowland herbaceous species or agricultural cropland plants. Additionally and as necessary, vegetation adjacent to roads and water bodies will be selectively cleared as described previously. It should also be noted that some vegetation will be damaged or destroyed in routes used to gain access to the ROW.

Clear-cutting will effectively destroy some tree species such as the pines. However, other species, such as aspen and birch, are capable of vegetative regeneration by sprouts and/or suckers. Thus, the application of herbicides (silvicides) on cut hardwood stumps is an integral part of clearing activities (ER, App. A, Sec. 2).

The vegetation will also be affected by tower construction and line stringing operations. In previously cleared portions of the ROW, the construction impacts will be incremental to those incurred during clearing operations. Winter construction in such areas will likely have a negligible effect on the vegetation. The applicant presently anticipates completion of a minimum of about 55 miles (88 km) of winter-season line construction in areas of poor access (ER Supp., Resp. to Q. 28).

Noted in Section 4.5.2.1, the construction of guyed aluminum towers does not require excavations for tower foundations and the preassembled towers will be emplaced by helicopter. Thus, the

impact area consists primarily of maneuvering space required for the equipment used to insert units of the helix screw anchor system that serves as the tower foundation. Corresponding impacts on the local vegetation would likewise be of limited areal extent. Also previously discussed, about 0.5 acre (0.2 ha) is required as a yarding area for assembling and erecting a self-supporting steel tower, a total of about 75 acres (30 ha) for the estimated 150 steel towers to be constructed in the line. For the most part, the use of steel towers will be limited to agricultural areas. Since the applicant will be responsible for damage or destruction of established crops, it is likely that vegetation impacted during steel tower construction will consist primarily of pasture and harvested cropland communities.

Other notable impacts on vegetation will be caused by the movement of heavy equipment used in tower construction and line stringing operations throughout the ROW. The extent of damage or destruction of vegetation will depend primarily on the condition of soils traversed. If the soils are frozen or relatively dry, the impacts on vegetation will be of minor significance. On the other hand, such activities could cause severe damage or destruction of vegetation during warm seasons when surface soils are saturated.

#### 4.4.1.2 Terrestrial Fauna

The most apparent impact on wildlife will be the destruction of habitat resulting from clear-cutting of the transmission line right-of-way (ROW) and access roads. Clearing of the plant communities within the ROW will have various implications regarding the effects on individual and/or groups of species. For example, a high proportion of the ROW includes lowland plant communities (see Tables 3.14 and 3.15) that are the preferred habitat for species such as spruce grouse, gray jay, hawk owl and boreal chickadee as well as mammals, including moose, arctic shrew, and southern bog lemming. However, the dispersion of these species due to clearing activities may not appreciably increase competition for offsite habitat resources since extensive areas of similar habitat occur adjacent to the ROW. In contrast, pine and northern hardwood communities are of relatively infrequent occurrence in the project area. Thus, clearing of these communities within the ROW may result in increased competition between species (e.g., blue jay, red crossbill, pine warbler, and eastern chipmunk) for food resources in adjacent similar communities.

The manner in which the various species utilize habitat resources of the area to be cleared are extremely variable. The habitat requirements of the white-tailed deer are completely compatible with resources occurring within the ROW. Of the more specific uses, the felling of hollow trees within the ROW will likely result in increased competition for den sites among species including raccoon, fisher, marten and red squirrel.

The ROW clearing and line-construction activities will result in the destruction of various forms of wildlife. Species of limited mobility, including amphibians, reptiles, small mammals and various invertebrates, will likely be physically destroyed or maimed by moving equipment. Other individuals will be buried and suffocate, including juveniles of the more mobile species that retreat to shallow burrows for refuge. Nests, eggs, and juveniles of tree and ground-nesting birds may be destroyed depending on the timing of clearing operations.

Project operations will also affect offsite wildlife populations. Animal-vehicle collisions will not likely occur within the ROW; however, increased project-related traffic on roads of the area surrounding active clearing and construction operations will result in a corresponding increase in road-killed wildlife. Further, as clearing operations proceed, the ROW will be used for convenient ingress into areas of previously limited accessibility causing increased hunting pressure and greater potential for poaching and harassment of wildlife.

The influx of humans and equipment as well as the noise generated by project operations will cause variously differing responses in animal populations of essentially uninhabited (humans) areas adjacent to some portions of the proposed ROW. Wilderness species such as moose, marten, fisher, and gray wolf tend to avoid areas of human activity. In some cases, juveniles may be abandoned during critical periods of development. Other species are little affected by such activities. The staff observed numerous showshoe hare immediately adjacent to winter clearing operations (Feb. 1978) in the vicinity of the project area.

The effects of noise on wildlife populations is not well known.[9] Various units of equipment used in project operations are expected to generate average sound-pressure levels of about 95 dB at 50 feet (15 m) from the source.[10] For comparison, the U. S. Environmental Protection Agency has identified the equivalent A-weighted 70 dB for a 24-hour period as the standard (with an adequate margin of safety) to protect the public against hearing loss due to intermittent sound.[11] For the most part, the auditory sensitivity of numerous wild animals is not known; however, it is very unlikely that wild animals will be subjected to noises of sufficient intensity or of sufficient duration to cause permanent hearing loss.[9] Aside from such considerations, high ambient noise levels may markedly affect predator-prey relationships. Predator species that rely on the sense of hearing to locate prey species may be at a disadvantage. Conversely,

the inability of a prey species to sense the presence of a predator may be fatal. Additionally, mating and distress or warning signals may be masked by high ambient noise levels,[9] thus significantly affecting the behavior of animal populations occurring in the impact area.

#### 4.4.1.3 Aquatic Fauna

Rivers

The major impacts associated with construction over rivers include: 1) disturbance of stream bottom and/or banks and increased turbidity caused by fording and right-of-way clearing, 2) elimination of shade near a stream edge, which may occur because of improper cutting and/or improper application of herbicide, 3) adverse effects on aquatic life due to herbicide contamination (ER, Sec. 2.2.2). Of primary concern is soil erosion where streams are crossed by transmission lines. Increased turbidity resulting from such erosion can significantly lower productivity in aquatic ecosystems. Inadvertent destruction of shade over streams will contribute to the destruction of that habitat for cold-water species of fish (ER, Sec. 2.2.1.1).

The applicant plans a number of mitigating measures that will minimize the environmental impact observed in the streams to be crossed by the proposed line. Construction throughout most of the line will occur during the winter, and as presently planned, all streams and wetlands will be crossed only during winter clearing and construction. Streams will be forded using packed snow bridges, a method now in wide use by loggers as well as the Minnesota DNR (ER Supp., Resp. to Q. 19). Should some semipermanent structure be needed at a stream crossing, "Bailey bridges" and culverts would be utilized (ER Supp., Resp. to Q. 20). Buffer zones of 300-400 feet (90-120 m) from the stream bank will retard erosion and runoff, and will serve to minimize visual impact. In addition, waterfowl food and cover will be developed and maintained in the vicinity of these crossings. Some areas will also be seeded with a desirable grass cover mixture for 300 feet (90 m) either side of the stream bank. In areas where the ROW intersects small streams as intermittent waterways, a bushy cover of alder and other shrubs will be maintained to provide food and cover for upland game. Where natural vegetation does not provide an adequate screening effect across streams such as in portions of the Big Fork, Rainy, and Red River watersheds (Figs. 3.3, 3.4, and 3.5), supplemental plantings of slow-growing conifers and low-growing deciduous trees and shrubs will be made (ER Supp., Resp. to Q. 16). District foresters with the Minnesota DNR will be consulted with regard to areas to be designated for screening.

The staff finds the above measures generally adequate to minimize any adverse impacts to streams crossed by the ROW; however, it is felt that two streams, the Big Fork (Fig. 3.4) and La Vallee (Valley) (Fig. 3.3) Rivers, should receive special consideration. For these streams, the staff recommends that a sufficient buffer zone be left so that the tower cannot be seen from the stream. Maximum spanning should be used across these rivers to absolutely minimize visual impact. In the case of the La Vallee, a very wide buffer zone is necessary to maintain stream shade and to minimize human access to its native trout population and so prevent overfishing. For the Big Fork River visual impacts are of primary importance, because of the possibility of its designation as a wild and scenic river.[12]

Due to adverse weather conditions, streams may have to be crossed at times other than winter. If such crossings are necessary, the staff recommends that they be limited to non-spawning months. This will minimize the impact to resident fish populations.

The staff finds the above mitigative measures as amended by recommendations acceptable and considers the impact to area streams caused by construction of the proposed line to be short-term and reversible.

Lakes

The proposed line crosses no lakes, although several are found in the corridor (see Table 3.8). The topography shows almost no relief in the areas where small concentrations of lakes lie in the general vicinity of the corridor. Since the cleared corridor is relatively small and the terrain flat, the staff does not expect erosion and runoff to have any effect on the water quality or biota of lakes in the region.

Wetlands

Since huge tracks of Type 8 wetland (bog)[13] will be crossed by the proposed line, major impact could potentially be felt in this environment due to construction of the proposed line. The applicant has proposed several mitigative measures to minimize adverse environmental impacts.

Construction throughout all bog areas is scheduled for winter. No grading or filling is planned in bog areas. However, because of uncertainties in the weather and because 70% of the entire

line construction will occur in bog (ER Supp., Resp. to Q. 21), the staff feels that a reasonable likelihood exists that some non-winter stream crossing and access road construction will occur in these wetlands. If such roads are constructed, they will follow the procedures outlined in "Construction Procedures in Wetlands; Forbes-International Border 500 kv Transmission Project" (ER Supp., Resp. to Q. 21). In addition, the location of all access roads will be examined by the Minnesota Department of Natural Resources before construction begins, and a permit from the Corps of Engineers under Section 404 of the Clean Water Act will be obtained.

The most potentially severe problem associated with the construction of temporary access roads is the obstruction of cross drainage in the bog. The applicant has provided a plan for adequate cross drainage along access roads (ER Supp., Resp. to Q. 21) and the staff finds it acceptable. In the plan cross drainages would be cut every 150 feet in access roads employing three distinct types of roadbeds. Selection of a roadbed type depends on soil conditions. While the roads would be permanent, little impact should be detected other than the displacement of organisms from the roadbed itself (see Sec. 4.4.1.2). The applicant will also inspect the terrain adjacent to any constructed roads on a regular and permanent basis to insure proper drainage.

The staff has evaluated all construction activities in wetlands, and the applicant's intent to mitigate adverse environmental impacts from them. The impacts are acceptable, short term, and largely reversible. Mitigative measures are uniformly reasonable and adequate.

### 4.4.2 Operational Impacts

#### 4.4.2.1 Noise

All EHV power transmission lines emit audible noise to some extent. The audible noise frequencies are generated by the corona discharge and the majority are in the range of human hearing. The applicant estimates that the audible noise level at the edge of the right-of-way, with a three-cardinal wet conductor, will be about 48 dBa (ER, Sec. 2, Fig. 2.1-0). Studies have shown that there are no complaints about HVL noise levels below 50 dB(A). (Ref. 14, App. D, Fig. 4, p. 31.)

#### 4.4.2.2 Voltage Effects

The electric field associated with an energized 500-kV transmission line may induce voltages in conducting objects within the field. If the object is well grounded, the resulting potential between the object and the ground will be near zero. However, if the object is insulated from the ground, significant voltages may be induced and a potential static shock hazard created. The magnitude of the charge and therefore the severity of the shock will be related to parameters associated with the transmission line design and voltage, size and dimensions of the object, the proximity of the object to the line, and degree of insulation of the object from the ground. The quality of the insulation between a person coming in contact with such an object and the earth will affect the severity of the shock.

Body-passage currents caused by contact with a charged object may range from barely detectable to those resulting in lethal effects. It has been reported by Dalziel[15] that currents less than about one milliampere (mA) produce little or no measurable physiological response. Therefore, these are not classed as shock currents. Shock currents have been classified into two groups according to the degree of severity of shock they produce.[15] A limit of 5 mA (NESC standard) is considered, by the Underwriter's Laboratory, as the maximum safe let-go current for the general population, including children.[16] Let-go current is the maximum current level at which a human holding an energized conductor can control his muscles enough to release the conductor. Secondary currents, although not dangerous in themselves, may cause involuntary movement which could trigger an accident. Currents of 6 mA or larger are considered primary currents. The most dangerous possible consequence of primary shock is ventricular fibrillation, a condition of incoordinate action of the main pumping chambers of the heart, resulting in immediate arrest of blood circulation. The current at which fibrillation begins varies with the weight of the person shocked and with the shock duration.[17]

According to the IEEE Working Group on Electrostatic Effects of Transmission Lines, "the value of ground gradient at the threshold of sensation (about 1 mA) is equal to or greater than 15 kV/m for the great majority of cases.[18] The applicant states that the maximum electrostatic field gradient resulting from operation of the 500-kV lines is expected to be 7 kV/m within the right-of-way at a point of minimum conductor-to-ground clearance. At the edge of the right-of-way it is expected to be 1.5 kV/m (ER, Sec. 2.1). These values are consistent with the design requirements that electrostatically induced voltages from the transmission line do not exceed the perception level. If the magnitude of the field is as intended, a person near or on the transmission line right-of-way should not be subject to a shock hazard.

The IEEE Working Group found that a significant shock hazard can develop if insulated conducting objects are placed in close proximity to high voltage transmission lines. In particular, they

state that "lethal currents can be built up on long insulated fences under such lines."[18] To prevent this occurrence, a consultant to the applicant suggests that all metallic fences which enter or cross the transmission line right-of-way be grounded according to established techniques (Ref. 14, App. D, Sec. 2.3.1, p. 23).

The IEEE Group also suggested that the "parking of vehicles in transmission line rights-of-way above 230 kV should be reviewed in detail on an individual basis."[14] Care should also be taken to assure that stationary structures, such as barns with metal roofs, are adequately grounded to prevent the build-up of electrostatic charge. As the IEEE Group states, "In all cases, careful grounding of objects or conductors will limit electrostatic hazards." The staff will require that the design and construction of the proposed 500-kV transmission line include provisions for an adequate program of grounding and surveillance to ensure that the probability of shock hazard will be minimized.

## Fuel Ignition and Shock Hazards

The line design needed to meet the National Electrical Safety Code 5 mA-limit will result in reducing the maximum spark energy to approximately 100 millijoules. Since this is in excess of the 0.25 millijoule limit for fuel ignition,[19] NSP/MP&L, as part of the easement process, will inform landowners not to fuel their vehicles in proximity to the transmission line unless grounding procedures have been carried out. In the report by Power Technologies Inc. (PTI) they state that there is no confirmed incident of fuel ignition resulting from refueling under a HVL (Ref. 14, App. D, Sec. 2.2.2, p. 18).

The danger of a shock hazard is < 0.5% that the safety limit of 5 mA will be exceeded in touching a nongrounded vehicle on the ROW (Ref. 14, App. D, Table 5, p. 11).

## Pacemakers

According to the PTI report (Ref. 14, App. D, Sec. 2.3.4, p. 25) reviewing the effects of magnetic fields on pacemakers, a magnetic field of approximately 1 gauss (G) was found to be a safe level for most people with pacemakers. The magnetic field under a 500-kV HVL is considerably less than 1 G.[7] Nevertheless, there are a number of documented instances of electromagnetic interference with implanted pacemakers.[20] It is therefore advisable that any population, e.g., farmers, that is liable to be repeatedly exposed, should be informed of the potential hazards, and advised to consult with their physicians about the sensitivity of their pacemakers. People driving under HVL are not at risk because the metal of the vehicle serves as a shield for occupants from an external electrical field.

## Low-Level Electric Fields

Investigations have been made to determine whether exposure to electrostatic fields such as those existing in transmission line substations result in adverse effects on humans.[21-23]

Studies of this nature were carried on in Russia and their results were reported at the 1972 International Conference on Large High Tension Electric Systems, Paris, France.[23] In this study, a systematic medical examination of about 250 persons working in 500-kV substations for a long time was undertaken and measurements were made of field intensities in various areas where these persons worked in 500-kV substations and in similar areas in 750-kV substations.

The report stated that "the examination showed that long-time work at 500-kV substations without protective measures results in shattering the dynamic state of the central nervous system, heart and blood-vessel system and in changing blood structure. Young men complained of reduced sexual potency." It was also concluded that "the depth of these functional diseases or troubles directly depends on the time of stay in the field." Criteria for permissible duration of personnel stay in electric fields were given and ranged from five minutes per day at 25 kV/m to unlimited time at 5 kV/m.

Studies were also carried out by members of the Johns Hopkins Hospital. Kouwenhoven et al.[21] have reported on the results of physical and medical examination of eleven linemen over a period of 42 months during the time they were performing live-line maintenance work on a 345-kV transmission system. Measurements of currents induced in a man's body when doing typical work on a 345-kV system, such as on transmission towers and in buckets, were reported on. In the former case, the man is grounded while in the electric field and in the latter, he is at line potential (barehand work). Body currents of 100 to 400 microamperes for the tower work and from 85 to 840 microamperes for barehand work were measured, depending on degree of bucket shielding used. Field intensities also were determined at various parts of the bodies of men doing barehand

work. These ranged from 0.4 kV/in. (16 kV/m) to 12 kV/in. (470 kV/m) at the top of the head to 0 to 4 kV/in. (160 kV/m) at the knees, depending on whether full or partial bucket shields were used.

As a result of this study, the authors reported that "Considering the period of observation (3-1/2 years) and the method of study, it can be reported that the health of the eleven observed linemen was unchanged by their exposure to HV lines. Also, no evidence of malignancy was found. There was a decrease in the sperm count of two of the 11 subjects. The significance of this is not clear and warrants further study; but no correlation has been found between exposure to HV lines and any effect on the health of individuals in this investigation. Among the 11 men tested, there were four who had many hours of barehand work during the period of this investigation. Not a single one of these men showed any change in his physical, mental, or emotional characteristics.[21]

Their laboratory studies remained entirely normal. No evidence was found that an adequately shielded lineman is endangered in any way by working barehanded in a HV ac electric field, within the limits of this study."[21] This report did not substantiate the findings of the Russian investigators.

In a follow-up report by the Johns Hopkins staff members,[22] results were reported on the continued examinations of ten of the previously examined linemen who were still employed by the power companies. The report covers a period of nine years ending June 1972 during which the men were examined completely seven times.

There were no significant changes of any kind found in the physical examinations, neither were there any significant abnormalities in any of the laboratory studies. No disease states were found that could be in any way related to the exposure of the men to high-voltage lines.

The investigators were aware of the Russian paper[23] and specifically looked for disorders described in it. In particular, no disorders in the functional states of the nervous and cardiovascular systems of the workers as reported by the Russians were found. The report cautioned, however, that in view of the two diverse populations examined with entirely different cultures, working conditions and environments, comparison of the two different studies should be "viewed with great caution."

The report of the follow-up examinations, therefore, did not change the conclusions reached in the earlier study.

The difference in results observed by the Russian and the U. S. and western European research groups are still unresolved although many more studies have been made. According to two recent reviewers[7,24] (in the U. S.) the mass of data support the contention that there are little or no HVL long-term effects on humans working in low-level electrical fields. The headache, fatigue, and nausea reported for switchboard workers[23] has been ascribed to extraneous stresses of the working conditions.[24] There is evidence, from a recent (1977) Soviet report,[25] that the generation of headache, fatigue and irritability is associated with the intensity of the field. They reported that humans exposed to 5 kV/m fields for two hours a day for 30 days, experienced no ill effects, whereas another group of subjects exposed to 15 kV/m fields for three 30-minute sessions, one hour apart, over six consecutive days, reported transient headaches, fatigue and irritability.

The positive demonstrations of effects of low-level electrical field appear to be associated with effects on the central nervous system. A number of studies of the effects of microwave radiation on blood brain barrier permeability have shown that a breakdown in the barrier takes place at levels below the U. S. accepted standards of 10 mW/cm$^2$.[26-29] The evidence supports the interpretation that this loss is the result of a rise in the temperature of the brain.[26]

The overall assessment by those who have recently reviewed the results of research on clinical and biological effects of low-level electrical fields, is that there is no convincing demonstration as to whether there are or aren't dangerous effects.[7,24,26,30]

Although the evidence for positive effects linked to significant health hazards is insufficient at this time to require any additional safeguards, the staff recommends that this question be reexamined in the future, as new data are produced.

## Ozone

Ozone is recognized as a major component of the photochemical air pollution-oxidant complex. Because of the possibility of adverse environmental effects caused by ozone generated from corona discharge in the vicinity of the proposed 500-kV transmission lines, this question has been reviewed by the staff. The National Primary Air Quality Standard for oxidants, as issued by the Environmental Protection Agency, is 80 parts per billion (ppb) by volume maximum arithmetic mean for a one-hour concentration, not to be exceeded more than once per year. However,

ozone may be injurious to vegetation, animals, and humans when concentrations exceed 50 ppb for prolonged periods.[31] Sensitive varieties of tobacco can be injured after eight hours exposure to 50 ppb ozone.[32] Metabolic effects, not accompanied by visible injury, have been observed in white pine at ozone concentrations of 100 ppb in only ten minutes.[33] Most humans experience discomfort when ozone concentrations approach 50 ppb, and laboratory mice show an increase in mortality when exposed to 100-2C0 ppb for a period of three weeks (7 hr/day).[34] It is difficult to assess the possible effect of a particular concentration of ozone on natural and domesticated biota or humans because almost every other environmental factor studied appears to interact with the ozone effect.[35] Duration of exposure, age, temperature, relative humidity, vigor, presence of other pollutants, and light intensity, among others, all affect the response of a particular species to ozone.

Ozone is produced naturally in the atmosphere by a variety of reactions. Dissociation of oxygen by ultraviolet radiation in the stratosphere and lightning discharges are probably the major natural sources of ozone. Ground-level ozone concentrations in areas distant from urban pollution sources usually range from 10 to 50 ppb.[35,36] Unusually high ozone concentrations (60-100 ppb) in remote areas may be due to mixing from the stratosphere by violent meteorological conditions or to photochemical reactions involving volatile compounds emanating from natural vegetation such as pine trees.[35]

Ozone and small amounts of nitrogen oxides are also produced by corona discharge from energized high voltage transmission lines. Corona discharge is determined by conductor surface potential gradients which in turn are dependent upon design parameters of the transmission system selected. Such parameters are height of conductors above the ground, spacing of the phases, ground wire configuration, size of conductor, bundle configuration, and transmission line voltage. The latter three are most significant. Corona will increase in any system as a result of abrasions, foreign adhering particles or sharp points on the conductor as well as by adverse weather conditions. Presence of water droplets on the conductor such as during foul weather will increase corona discharge greatly. The use of larger and multiple conductors per phase (bundling) is particularly effective in reducing corona discharge for any other given set of conditions. Through the use of such design alternatives, higher voltage systems such as 500 kV may be operated with no greater corona discharge and its consequences than lower voltage systems presently acceptable. The staff believes that the NSP transmission system design has utilized these alternatives.

Several field studies[37,38] have attempted to measure increases in ambient ozone levels near energized 765-kV lines. No increase in ambient levels were found even when detectors were placed six meters downwind from the conductor at the conductor height. Tests were performed under a variety of weather conditions with similar results. However, the staff considers both of the field studies summarized above to be deficient in one or more areas of procedure, analysis or interpretation. For example, during corona discharge the amount of corona loss (and presumably ozone production) around high-voltage transmission lines increases by a large factor with small increases in voltage--a 5% increase in voltage can almost double the corona.[39] Yet neither of the field studies report the actual line voltage at the time the ozone measurements were made. It should be emphasized, however, that in no case were ozone levels detected that were measurably above ambient levels.

Based upon the cited references, the staff believes that the proposed transmission line can be operated with no unacceptable impacts resulting from the generation of ozone. Contributions from the line are expected to constitute a minor part of ambient ozone levels that are principally generated by natural processes and well below the National Primary Air Quality Standard described above.

#### 4.4.2.3 Effects on Flora

The applicant will manage vegetation within the ROW to maintain the operational integrity of the line and enhance food and cover habitat for wildlife consistent with agricultural and other uses of portions of the ROW. The procedures and practices to be employed are discussed in Section 2.6.2.2; thus, the following is a brief summary of the proposed management program.

Subject to easement agreements to the contrary, approximately the central one-third of the ROW will be maintained in naturally occurring or planted herbaceous cover. Management will be oriented toward promoting or establishing low growing shrubs in areas immediately adjacent to this herbaceous cover. Exterior portions of the ROW will be managed to promote growth of taller shrubs and low growing trees that are beneficial to wildlife.

Electromagnetic effects on plant species have been investigated under various conditions and by various individuals and organizations.[7,24] Miller and Kaufman report that the general conclusion from numerous investigations "is that there is an absence of biological effects from current levels at all comparable to those experienced by a person or any living object underneath an operational 750 kV line."[7] However, exceptions are noted and these authors report observing

leaf tip corona burn on very tall and vigorously growing maple and maple seedlings (with pointed leaves) growing directly under an operational 750-kV line; the electric field just above the plants was about 34 kV per meter. The rounded leaves of an equally tall sassafras sapling were unaffected.[7] The maximum ground-level field strength immediately beneath the proposed 500-kV line will be about 7.5 kV per meter. The staff expects no observable electromagnetic effects on vegetation managed as proposed by the applicant.

#### 4.4.2.4 Effects on Fauna

Terrestrial

Whereas the initial effects of ROW clearing on wildlife species are almost invariably of a negative nature, the subsequent development of vegetation in the cleared area results in the creation of the so-called "edge effect." Typically, a greater amount and variety of animal foods are produced and a wide variety of ecological niches are created. Additionally, various portions of the ROW will be utilized for travel lanes and escape cover. Although the applicant's proposed measures for managing habitat within the ROW are oriented to favor major game species (Sec. 2.6.2.2), such management will be beneficial to numerous nongame species as well. In total, the potential of active management will likely be a favorable trade-off for the negative effects incurred.

Some of the negative impacts associated with clearing and construction will also prevail during line operation. The intensity of hunting and related activities will likely continue at similar levels. The incidence of road-killed wildlife will likely decrease since the vehicular traffic required for normal line maintenance will be negligible compared to that associated with the construction period. Maintenance practices and schedules are discussed in Section 2.6.2; normally such activities will not likely cause other than minor disturbances of wildlife. However, some species may tend to avoid the ROW because of noise generated during monthly inspections from aircraft.

Corona effects associated with line operation will not likely affect wildlife behavior during fair weather conditions. However, audible noise generated by corona and spark-gap discharge may exceed 55 dB at ground level beneath the line during foul weather (Sec. 2.6.1.1). In view of previous discussion concerning noise levels associated with line construction, it is unlikely that wildlife in the vicinity of the proposed line will suffer permanent hearing loss. However, the less tolerant species may vacate or avoid the ROW during foul weather. Additionally, predator-prey relationships as well as communication signals may be altered, as previously noted. Miller and Kaufman[7] have evaluated information sources relative to other effects associated with high-voltage transmission. These authors conclude that current evidence does not convincingly indicate harmful biological effects resulting from exposure to electric and magnetic fields or corona-induced production of ozone associated with transmission lines. Thus such phenomena are not likely to affect wildlife in the proposed project ROW.

Towers of the proposed facility will be utilized as resting perches and observation posts, particularly by raptors during hunting forays. The distance between conductors and the tower design essentially preclude electrocution; nonetheless, the towers and cables of the facility constitute a hazard to flying birds. Various records indicate instances in which substantial numbers of birds have been killed due to collisions with tall man-made structures, including power lines.[40] Most of the data are based on migrating passerine birds colliding with TV antennas and tall structures at airports that exceed tower heights of the proposed line. However, birds commonly fly at lower levels during stormy weather. In any event, some bird kills will occur following construction of the proposed facility.

Speculation as to the kinds and numbers of birds that will be impinged by the proposed facility is near meaningless. However, several considerations seem relevant. According to Bellrose, none of the primary goose and duck migration routes traverses the project area.[41] However, a secondary goose migration route traverses the Hibbing area, the eastern portion of the proposed transmission line (see Fig. 2.1). For the most part, the orientation of the proposed line in this area is a north-south direction which corresponds with the direction of migration. Secondly, agricultural croplands, commonly used by migrating species as resting and feeding areas, are not extensive in the vicinity of the proposed line. Further, the habitat resources of the Big Bog (Networks 2 and 3, Fig. 2.1) are not considered conducive to sustaining dense populations of bird species. Accordingly, the staff believes the incidence of bird kills associated with the proposed line will be relatively low. However, given the instances of interaction between certain species behavioral patterns, specific timing, and the occurrence of particular inclement weather conditions, some appreciable bird kills may occur.

Aquatic

The operation of any transmission line is in general a "passive" activity with respect to its effect on the aquatic environment. The most potentially severe impacts to rivers, lakes, and wetlands along the corridor are associated with the use of herbicides to control vegetation and the possiblity of oil spills at substations.

The applicant has provided no list of herbicides, application rates, carrier agents, or methods of application to the staff for evaluation. It is the intent of the applicant to conform to the guidelines of the State of Minnesota Department of Agriculture and the USEPA, but these guidelines are still being promulgated (ER Supp., Resp. to Q. 17). The applicant is committed to the following measures and safeguards regarding the use of herbicides for transmission lines maintenance (ER Supp., Resp. to Q. 30 and Ref. 42):

1. Types of herbicides used are restricted to only those chemicals and methods of application approved by the Minnesota Department of Agriculture and the USEPA.
2. Selective or basal application shall be used wherever possible. No spraying shall occur near any area defined by the Minnesota DNR as environmentally sensitive.
3. The applicant shall mark all nontarget wildlife habitat in areas where broadcast spraying is unavoidable, so that these areas will be spared the needless application of chemicals.
4. Buffer areas of at least 300 to 400 feet for aerial applications and 100 feet for general applications shall be left around all open water bodies.
5. The applicant shall supply the Minnesota Department of Natural Resources with the names, application rates, carrier agents, and methods of application of all herbicides anticipated for use in ROW maintenance no less than two working days before the commencement of spraying.

The possibility of an oil spill at Forbes substation (owned by Minnesota Power and Light) has been virtually eliminated due to the construction of catch basins which will contain the oil in case of an accident. In addition, the MEQB construction permit has required the following preventative measures to be taken at all locations throughout the right-of-way:

1. Staging and storage sites should be located away from water bodies to prevent oils and chemicals from entering and adversely affecting these waters. All such storage of oils and chemicals shall comply with Minnesota Pollution control regulations.

In addition, the staff recommends that the following procedures be observed to minimize operational impacts to aquatic systems:

1. Application of herbicides shall be limited to hand-held apparatus within 100 meters of any body of open water.
2. Spraying of any type shall not take place during the nesting seasons of waterfowl, nor in areas of wetland having substantial open water during periods of nesting and/or migration.

The staff assumes, for purposes of this analysis, that the regulations to be promulgated by the Minnesota Pollution Control Agency are adequate in terms of their intent towards minimizing adverse environmental impacts. We reserve the right, however, to offer supplemental analyses upon review of the forthcoming guidelines. Pending such review, the staff finds the potential environmental impacts to the aquatic environment due to the operation of the proposed line to be minimal and acceptable upon adoption of the provisos previously mentioned.

## 4.5 IMPACTS ON ENDANGERED SPECIES

### 4.5.1 Construction

In order to ensure compliance with Section 7 of the Endangered Species Act of 1973, the Department of Energy has requested formal consultation with the U. S. Fish and Wildlife Service concerning impacts which may occur to the gray wolf, bald eagle, and peregrine falcon from construction and operation of the applicant's transmission line. The results of the FWS "threshold examination" are presented in Appendix C. This document states that "by increasing prey species the net effect upon grey wolves will be positive thus improving critical habitat," The conclusion reached by the FWS is that "this project will not jeopardize the continued existence of the gray wolf, peregrine falcon and the bald eagle nor will it result in the destruction or adverse

modification of designated critical habitat for the gray wolf."

The greatest potential for adverse impacts to the wolf during construction will arise from interactions with human populations. During the clearing phase of construction, the wolves of the area may be subject to stress due to noise and human interference. Because this area has somewhat of a "wilderness" character, human intrusion may not be tolerated by the wolves, resulting in abandonment of parts of existing territories by the wolves. This may increase competition between displaced animals and resident animals for the habitat resources of the adjacent areas. Such secondary effects as changes in food availability and species behavioral patterns may result.

An increase in human population of the area also will likely increase road kills, poaching, and general harassment of not only the wolves, but their main source of food as well. Since most of the construction work will take place during winter, which is generally recognized as the period of highest natural mortality for the wolf, this may result in an even higher than normal mortality rate.

Aside from the impacts directly associated with the construction of the transmission line, additional impacts may occur if the applicant sets up temporary work camps with house trailers (see Sec. 4.7).

As a result of all the above mentioned potential and/or probable impacts, the wolf population of Zone 3 may experience an overall net decline during the one- or two-year construction period.

Construction impacts to the bald eagle are expected to be minimal. Provided the applicant follows the recommendations of the Minnesota DNR and restricts the line to at least one-half mile from known eagle nests, the possibility of desertion by the eagles is reduced. In addition, most of the construction work will be done during winter, when most of the eagles will have migrated to open water, such as the Mississippi River.

No impacts to the peregrine falcon are expected to occur as a result of ROW clearing and line construction.

The staff recommends that the applicant instruct the work force regarding possible harassment and other adverse impacts to wildlife species during the construction period. An understanding and appreciation for basic ecological relationships and principles will serve to minimize the potential for impacts to threatened and endangered species as well as to wildlife in general. The staff recommends that the applicant perform this task through meetings and the issuance of pamphlets to the workmen who will be actually working on construction.

Since no federally designated threatened and/or endangered species of aquatic animals are found within the corridor, no impacts to any so designated species will occur from construction activities associated with the proposed transmission line.

### 4.5.2 Operation

Operational impacts to the wolf are expected to be both positive and negative. The presence of the ROW will provide new access to the wolves' critical habitat for hunters and persons engaged in other recreational activities. This may promote higher human densities leading to competition with the wolves for their habitat and prey. However, the applicant has indicated (ER, App. Aa) that the ROW will be managed during operation to maximize the quantity of winter browse for deer and moose. If the critical habitat area is managed carefully to limit the number of wolf-human interactions, the overall impact to the wolf from the operation of the transmission line may be beneficial because of a net increase in prey.

Line-maintenance ground crews and aerial surveys may cause some minor disturbance to both the eagle and wolf during operation, but such impacts will be of short duration.

While the towers and lines pose a potential inflight hazard to birds, the lines will be constructed in such a way as to preclude electrocution of large raptors, such as the eagle.

Since no aquatic species designated as threatened and/or endangered are found within the corridor, no impacts to any so designated species will occur from the operation of the proposed transmission line.

## 4.6 IMPACTS ON CULTURAL RESOURCES

### 4.6.1 Survey Program

The applicant has agreed to conduct a survey for historic and archeological resources in the transmission corridor and has submitted a research design and survey schedule (ER Supp., Resp. to Q. 1 and 2). This survey will be made in the portions of the corridor that are not covered by the deep bog vegetation. Bog and muskeg are estimated to make up a minimum of 65% of the corridor (approximately 215 km) (Research Design submitted in response to Q. 1 and 2). These areas will not be surveyed for several reasons. First, they have a heavy annual accumulation of organic material which would have buried prehistoric materials beneath tens of feet of accumulated peat. Thus any buried resources that might exist should be little affected by construction (ibid). Second, the bog areas would be inaccessible (ibid) during some periods of the year, even if deep testing strategies could be efficiently designed.

The remaining corridor will be examined in a two-phase program. Phase One will be a combined surface walkover and subsurface shovel testing program along ten-meter transects following the corridor. Phase Two will involve subsurface testing and sampling of any sites located during the Phase One reconnaissance. More details on both phases are presented in the Research Design provided by the applicant's consultants.

The applicant states that all cultural resource sites located at a structure point will be excavated or that tower placement will be altered so as not to disturb the site (ER Supp., Resp. to Q. 1 and 2).

### 4.6.2 Evaluation of Impacts

The staff will evaluate the results of the survey and proposed mitigation plans when this information becomes available. In addition, the State Historic Preservation Office of Minnesota will be notified that the survey will be conducted and will be asked to comment on the importance of any cultural resources located in the corridor or identified during Phases One and Two of the applicant's survey.

## 4.7 IMPACTS ON THE COMMUNITY

### 4.7.1 Demography

#### 4.7.1.1 Relocation

The construction of the Northern States Power transmission line will affect the demographic structure of the six-county project area described in Section 3.8 by the stimulation of temporary inmigration of personnel associated with the work force and local relocation of people living within the right-of-way. Acquisition of easement rights could result in the relocation of 13 households living in homes within 500 feet of the proposed centerline.[5] Construction-related activities may also directly or indirectly result in social, political, and/or economic impacts leading to local outmigration or relocation. However, the number of residents affected is expected to be a very small fraction of the total population of the impact area.

#### 4.7.1.2 Inmigration

The applicant has indicated they expect a total of 100-300 workers for the two and one-half year project, with the maximum work force required from November through March and the minimum in April through June. Based upon past experience NSP anticipates that 50-70 percent (150-210 workers) of the construction work force will move into the impact area and that 20-30% of these inmovers will bring their families with them (ER Supp., Resp. to Q. 4). It is estimated that 60% of the workers will be married and have families and that each family expected to move into this area will have on the average two to three children (ER Supp., Resp. to Q. 4). Therefore, the maximum inmigrating population at any one time is expected to be about 460 individuals.

### 4.7.2 Settlement Pattern

#### 4.7.2.1 Housing and Industry

The potential impacts on housing are primarily a function of: (1) the number and distribution of the inmigrating population, (2) historic and projected local housing demands, (3) kind, number, and distribution of existing vacant housing units, and (4) planned additions to housing including the ability of the local and private real estate development market to respond to demand.

Impacts resulting from inmigration of the construction force will probably be centered in the six-county area described in Section 3.8. Most housing demands are expected to be made on the larger towns such as Hibbing, Chisholm, Virginia, International Falls, Big Falls, Baudette, Warroad and Roseau (ER Supp., Resp. to Q. 4). Due to the seasonality of the work and the fact that it is not concentrated in one place, but instead is essentially progressive, moving from one point to another--200 miles (320 km) away--most workers are expected to choose temporary housing in motels, mobile homes or rental apartments and houses (ER Supp., Resp. to Q. 4). While there may be times when the work force is spread out over the 200 miles, most of the time the workers may be concentrated in one area, before moving 50-100 miles (80-160 km) to the next area of concentration.

Projected local housing demands are related to demographic trends, which are in turn modified by various economic and socio-cultural factors such as price, housing availability, housing demand, length of stay, etc. In all but St. Louis County, populations have been relatively stable (see Sec. 3.8). Even so the availability of temporary housing appears to be very tight. For the four-county area of Beltrami, Itasca, Lake of the Woods, and Koochiching there were about 32,600 housing units in 1970. Of those 80-90% were single family homes, 5-12% duplexes or apartments and another 2.5% were mobile homes.[43]

A 1976 study done for the proposed Minnegasco Peat Gasification Project indicated that the vacancy rate in the four-county area was only 2.2%, evenly split between rental and those for sale, with more than half of each without plumbing facilities.[43] The study also stated that "it is not unusual for small towns in the area to have only two or three vacant housing units per year." However, since the average family income is low compared to the state (see Sec. 3.8), it is not surprising that the median rent paid by persons of this four-county area is relatively low, ranging from $40-59 per month in Koochiching County to $60-79 per month in the other three counties.[43]

A recent study done for the village of Baudette in Lake of the Woods County, may further substantiate the presence of a housing problem in this area. Out of a total of 551 dwelling units (including single family homes, mobile homes, and apartments of all conditions), only 35 were vacant in 1976 of which 26 were in either a substandard or dilapidated condition. This left three single family homes and six apartments available for housing.

Although little information is available, it would appear that circumstances may be similar in Roseau County as well. A report on the overall economic development of the Northwest Region[44] (including Roseau County) indicates that 25% of the region's housing is deemed to be inadequate (either overcrowded or lacking essential plumbing) with Roseau County accounting for "a sizable portion of this percentage."[44] Moreover, "recently the housing market has become critically tight, and in the area of renting, there is a definite demand for apartment dwellings. This demand is more pronounced in the 'urban' centers of the region."[44] Furthermore, the report also identified a shortage of lodging facilities such as motels in the Warroad area.[44]

Housing availability appears to be critical in St. Louis County as well. The primary cause of housing shortage in this area is the result of the rapid growth of the taconite industry, which is occurring all across the Iron Range area.[45] A recent report made available to the staff from the Planning Department for the City of Hibbing indicates the vacancy rate in 1976 in Hibbing was less than 0.5%, and vacant units are critically substandard and nonmarketable.[46] The report lists a total of 6111 housing units (1653 renter-occupied) with 174 vacant units; however, this includes 145 units under construction and 26 of the remaining 29 being substandard units, violating one or more significant aspects of the Hibbing Housing Code. Furthermore, a survey of realtors in Hibbing indicated that all but one realtor have client waiting lists of about fifty families, with at least one listing more than 100 families seeking housing in Hibbing.[46]

It would appear the situation is similar in other areas of St. Louis County. The town of Stuntz experienced one of the highest growth rates of the area from 1970-1975 and requested a special census showing an increase of 12.7% since 1970.[47] The St. Louis County Planning and Zoning Department indicated one of the factors attributed to the increase was a shortage of housing in other communities. Since 1967 to 1977, the town of Stuntz has experienced a 38% increase in the number of dwelling units.[45]

#### 4.7.2.2 Transportation

Due to the inmigration of up to 300 workers in the rural communities of northern Minnesota traffic may be a problem in some areas. Since the housing supply is rather limited and the towns are, in some cases, 50-60 miles (80-97 km) from the proposed route, the workers may have to drive a considerable distance to and from the job site. This increase in concentrated use of specific highways such as US 71, State Highways 1, 6, 11, 65, and 72, may cause some problems to residents of the area. However, since the major portion of construction is to be done in winter, tourist traffic will be at a minimum. The transportation of heavy equipment may increase deterioration of the roads in this area.

### 4.7.3 Social Organization

The inmigration of construction workers and their families may affect the social organization of the project area by producing changes in the social structure of the local residents and by increasing demands for social services. Social services include education, sewer and water facilities, and health and medical services.

#### 4.7.3.1 Social Services

Education

The public school systems of the six-county area are expected to educate the inmigrating school-aged children. The applicant has indicated they would expect no more than 100 children would be added to the total school enrollment of the project area, and this estimate is probably due to the seasonal nature of the work which will discourage some of the workers from bringing their families (ER Supp., Resp. to Q. 10). Impacts to the school systems of the area are expected to be minimal due to the general decline in enrollments, 13 grades of the school system, and the relatively short time-period that workers will spend in one area.

Sewer and Water Facilities

From the data on four cities of the Iron Range (Grand Rapids, Hibbing, Chisholm, and Virginia), it appears the capabilities of sewer and water facilities are more than adequate for St. Louis County.[48] However, facilities for the other five counties appear to be at their limit in some cases and inadequate in others, violating Minnesota Pollution Control Agency standards. New or expanded sewage systems are needed in Baudette, Bemidji, Blackduck, International Falls, Kelliher, Northome, Roseau, and Warroad.[43,44] Water system inadequacies or a need for extensions exist in all of the above and in Big Falls as well. Any additional demands on these systems, such as those of a temporary trailer camp established for the work force, could create a major problem.

Health and Medical Services

The adequacy of institutional medical care for workers and their families will depend on the locality in which the workers live. Table 4.1 provides the number of beds and occupancy rates for hospitals in the six-county area. Given present occupancy rates, it would appear that there are adequate facilities for the construction workers and their families. However, Roseau County has been designated a critical health manpower shortage area for physicians, dentists, and nurses.[44] In addition, Beltrami County also appears to have a critical shortage of primary physicians, while Lake of the Woods County has only one dentist for the entire county in 1974.[49]

Table 4.1. 1977 Summary of Institutional Care in the Six-County Impact Area[a]

| County | Hospital | Number of Beds | Occupancy Rate, % |
|---|---|---|---|
| Beltrami | Bemidji Community Hospital | 135 | 81.6 |
| | U. S. Public Health Service Indian Hospital | 30 | 40.0 |
| Itasca | Northern Itasca Hospital | 60 | 66.7 |
| | Itasca Memorial Hospital | | |
| Koochiching | International Falls Memorial Hospital | 64 | 60.9 |
| | Littlefork Municipal Hospital | 62 | 85.5 |
| Lake of the Woods | Trinity Hospital | 34 | 45.7 |
| Roseau | Roseau Area Hospital | 133 | 87.2 |
| St. Louis | Chisholm Memorial Hospital | 54 | 29.6 |
| | Eveleth Fitzgerald Community Hospital | 50 | 54.0 |
| | Hibbing General Hospital | 180 | 70.2 |
| | Virginia Municipal Hospital | 295 | 81.7 |

[a]Derived from "American Hospital Association Guide to the Health Care Field," American Hospital Association, Chicago, 1977.

All of the other counties in the project area have ratios of doctor to population totals approximately equal to or above the state average.[49] While the applicant has indicated the company expects only a total of 30 time-loss accidents associated with the entire construction phase (ER Supp., Resp. to Q. 8), this may cause a substantial impact on an already critical problem. In addition, the inaccessibility of ambulance service to the job site may cause serious transportation problems to those men injured on the job.

### 4.7.4 Economic Organization

#### 4.7.4.1 Direct Impacts

In the peak construction period of the year, the applicant estimates direct NSP employment of 300 workers with an average individual monthly wage of between $1600 and $3000 depending on the individual job (ER Supp., Resp. to Q. 4). Some of these workers (30-50%) may be recruited from the local work force. The average monthly payroll should be between $300,000 and $375,000, depending on the season and number of workers. The local communities in which the construction workers live, including the six-county area, will receive benefits from both the investment of a portion of these wages through the direct purchases of local goods and services and in local labor recruitment.

#### 4.7.4.2 Indirect Impacts

The construction of the NSP transmission line will also provide indirect benefits to the six-county area. For each dollar spent locally by NSP (for labor, goods, and services), there will be additional economic activity and expenditures generated in the local area as these workers and businessmen spend part of this money. Furthermore, the construction workers are expected to have a multiplier effect on local employment in terms of base-to-service ratios.

As the construction of the line nears completion and workers leave an area, the demand for some goods and services may decrease to near the preconstruction level. However, if the impact area experiences continued growth in local economic developments during the construction stage, the post-construction impacts may be less severe. This would occur if the new entrants to the region utilize some of the housing and services left by the NSP construction force.

### 4.7.5 Political Organization

Direct impacts to the local political organization may affect the continued and efficient operation of the county and municipal government. Maintaining the efficiency of local governmental bodies is important to the successful reduction of impacts, particularly when solutions to specific problems require a relatively long lead time. NSP should work closely with local and county officials as well as local planning commissions if any temporary housing facilities such as trailer camps are to be used.

Direct impacts may also affect local police and fire services. Most of the towns in the impact area have some law enforcement personnel, with the county sheriff's department providing protection for the other towns and rural areas. Except for the larger towns of the Iron Range, the majority of fire protection personnel are volunteers. The inmigrating workers and their families may increase demand for fire and police protection requiring additional personnel and equipment in some areas. This may be particularly true if temporary work camps are established.

### 4.7.6 Recreation

The general recreational facilities of the six-county area are discussed in Section 3.8.3, and a more specific list of the facilities is given in Table 4.2. This area has extensive outdoor recreation opportunities for the project area residents and should be able to accommodate many kinds of projected demand in the near future. The influx of 460 people at the construction peak is not expected to stress available outdoor recreation. In addition, the route finally designated by the Minnesota Environmental Quality Board avoided all of the major recreation areas, such as state parks.

Benefit to some of the motels and resorts of the area may occur during the off-season for tourists if workers choose these accommodations.

Although no adverse recreational impacts are anticipated for the general area, problems could occur in response to the supply and demand for specific kinds of recreational preferences. Such detailed preference data are not available for subregional populations in the project area and for the construction work force.

Table 4.2. Six-County Inventory of Outdoor Recreation Facilities[a]

| Type | St. Louis | Itasca | Koochiching | Baltrami | Lake of the Woods | Roseau | Total |
|---|---|---|---|---|---|---|---|
| Tent Camping | | | | | | | |
| No. of areas | 44 | 14 | 9 | 5 | 8 | 2 | 82 |
| No. of sites | 212 | 53 | 77 | 34 | 61 | 14 | 451 |
| Vehicle Camping | | | | | | | |
| No. of areas | 50 | 74 | 14 | 40 | 17 | 3 | 198 |
| No. of sites | 902 | 1133 | 138 | 631 | 366 | 30 | 3200 |
| Total Camping | | | | | | | |
| No. of areas | 94 | 88 | 23 | 45 | 25 | 5 | 280 |
| No. of sites | 1114 | 1186 | 215 | 665 | 427 | 44 | 3651 |
| Picnicking | | | | | | | |
| No. of areas | 111 | 114 | 23 | 48 | 18 | 8 | 322 |
| No. of sites | 825 | 432 | 41 | 328 | 62 | 31 | 1719 |
| Trails-Miles | | | | | | | |
| Snow | 327 | 298 | 229 | 92 | 112 | 54 | 1112 |
| Hiking | 70 | 121 | 4 | 64 | 17 | -- | 276 |
| Multi-Use | 41 | 119 | -- | 51 | 8 | -- | 219 |
| Nature | 4 | 12 | 3 | 8 | 7 | -- | 34 |
| Golf Courses (9 and 18 holes) | 18 | 4 | 1 | 3 | 1 | 2 | 29 |
| Tennis | | | | | | | |
| No. of courts | 46 | 32 | 4 | 10 | 1 | -- | 93 |
| Playgrounds | | | | | | | |
| Number | 123 | 92 | 16 | 71 | 16 | 3 | 321 |
| Acres | 78 | 28 | 10 | 37 | 3 | 3 | 159 |
| Athletic Fields | | | | | | | |
| Number | 86 | 37 | 15 | 19 | 4 | 5 | 166 |
| Acres | 321 | 157 | 54 | 129 | 17 | 26 | 704 |
| No. of Ball Fields | 104 | 38 | 17 | 17 | 3 | 5 | 184 |
| Ice Skating | | | | | | | |
| No. of rinks | 74 | 21 | 5 | 10 | 2 | 3 | 115 |
| No. of Swimming Beaches | 106 | 134 | 14 | 81 | 12 | -- | 347 |
| No. of Swimming Pools | 4 | 3 | -- | 7 | 1 | 1 | 16 |
| No. of Boat Accesses | 203 | 186 | 30 | 93 | 18 | 2 | 532 |
| No. of Marinas | 100 | 121 | 15 | 86 | 31 | 1 | 354 |
| No. of Ski Areas | 5 | 2 | -- | 1 | -- | -- | 8 |

[a]From "Minnesota State Comprehensive Outdoor Recreation Plan--1974," Minnesota Department of Natural Resources, 1975.

### 4.7.7 Conclusion

The staff concludes that as a result of construction of the NSP transmission line, there could be temporary primary and secondary impacts to the settlement pattern and the social, economic, and political organization of the project area. Impacts are most likely to occur in the six counties of Beltrami, Itasca, Koochiching, Lake of the Woods, Roseau, and St. Louis. From an examination of the available data and estimates given by the applicant, it would appear that temporary trailer camps to house the workers during at least part of the construction phase will be necessary. At the present time, not enough information is available regarding the size and location of these camps (if they are necessary) and therefore the impacts from the camps and mitigative measures to reduce them will be examined in the Final Impact Statement.

## 4.8 IMPACTS ASSOCIATED WITH SUBSTATION FACILITIES

As related in Section 2.4.2.4, substation facilities associated with the proposed NSP transmission line will be located within the Forbes substation, which is owned and currently expanded by Minnesota Power & Light Company (MP&L).[50] The 17.4-acre (7-ha) expansion of the substation, completed in 1978,[51] serves MP&L's current needs and also provides reserve capacity for additional substation facilities (ER Supp., Resp. to Q. 31).

A relatively small portion of the reserve area within the Forbes substation will be utilized for the emplacement of facilities (Sec. 2.4.2.5) required for the proposed line from Forbes to the international border. Thus no change in land use is at issue, nor will site preparation operations be necessary. Physical site disturbance directly attributable to NSP activities will essentially be limited to excavations for equipment and structure foundations, and the disposal of excavated material. Construction effects on biotic and water resources and air quality are expected to be negligible or of a minor nature. Construction noise will be incremental to the noise of the currently operating substation, and will not likely be a significant problem since the substation is located in a rural area. The installation of the facilities will be accompanied by an influx of construction personnel and some increase in local traffic. The related effects will be of short-term duration and incremental to those resulting from construction of the proposed transmission line; the latter are discussed in preceding sections.

Following activation of the proposed NSP transmission line, the environmental effects associated with line-related substation facilities will be indistinguishable from those of similar facilities within the station. The staff finds that the potential adverse effects associated with the planned substation accommodations are not of sufficient intensity to warrant disapproval of the proposed project.

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# 5. UNAVOIDABLE ADVERSE IMPACTS

## 5.1 CONSTRUCTION IMPACTS

The task of clearing the ROW will have various unavoidable adverse impacts on biota. Timber and shrub species will be cut and burned, particularly in areas that are relatively inaccessible and which have poor quality timber. The losses of vegetation during the clearing will eliminate nesting habitat, cover and foraging areas for various wildlife species residing in the ROW. Relatively immobile subterranean animal species will be destroyed as a result of soil compaction and vegetation removal.

Right-of-way clearing during winter is not expected to result in appreciable soil erosion. Clearing will occur in bog areas when the ground is frozen, thus minimizing the potential for erosion. However, in areas cleared during summer, some soil erosion may occur.

The placement of towers will preclude the use of approximately 0.03 acre (0.01 ha) under each free standing tower and approximately 0.23 acre (0.09 ha) around each guyed tower for the lifetime of the line. The total land area under the 150 self-supporting steel towers will be 4.5 acres (1.8 ha). During the erection of the towers about 0.23 acre (0.09 ha) needed as a yarding area for assembling and erecting a self-supporting steel tower will be disturbed--a total of about 35 acres (14 ha) for the 150 towers to be constructed in the line. The approximate total area to be temporarily disturbed around the 650 guyed towers is estimated at 150 acres (60 ha).

The stringing of conductors will result in soil compaction at various localized areas along the line. This impact will be greatest in areas where conductors are strung when the ground has thawed. Impacts from soil compaction are expected to be short-term ones, lasting approximately two to four years.

The nonrenewable resources used in tower construction will include 4000 tons of steel, 8400 tons of aluminum and 24,000 cubic yards of concrete. The aluminum and steel will be recycled once the line has been decommissioned. The concrete footings, however, will be left in place.

The applicant has indicated the necessity of building access roads for the passage of equipment and supplies to the construction sites. The extent of the impact from the construction of the roads cannot be determined since the exact locations and numbers of roads are unknown. The staff believes, however, that loss of vegetation and wildlife displacement will occur from the clearing and construction of these roads. Temporary disturbances to wildlife species in the area will result from vehicular traffic on access roads.

The construction work force is expected to place increasing demands on local housing, schools, medical facilities, and other community services, particularly in portions of Networks III and IV. If the applicant decides to allow the construction contractors to establish work camps along the line other impacts are likely to occur. The physical presence and noise generated by personnel in these camps will tend to interfere with behavioral patterns of various wildlife species. Other impacts, such as soil compaction and damage to vegetation in the immediate vicinity of a camp, are likely to occur. The intensity of these impacts is expected to be directly related to the size and duration of the camp.

## 5.2 OPERATIONAL IMPACTS

The physical presence of conductors and towers along the line is expected to have adverse esthetic impacts. These impacts will be greatest in areas where the line traverses streams and highways. One stream crossing of particular concern from the standpoint of adverse visual impacts is at the Big Fork River in Network II. This portion of the Big Fork River has high scenic value and may become designated as a wild and scenic river (see Sec. 3.3.1).

The energized conductors will produce audible noise of 48 dBa at the edge of the right-of-way during periods when the conductors are wet. This noise level is not expected to adversely impact any residents living near the right-of-way. Audible noise may be somewhat annoying to persons walking along the right-of-way.

Some radio and TV interference may be noted by persons living adjacent to the right-of-way. The applicant has committed to procedures for mitigating TV interference for those residents registering complaints.

The vegetation management program to be instituted along the right-of-way during operation of the line will eliminate habitat for certain wildlife species. Wildlife dependent on tall trees and dead trees will not inhabit the right-of-way since line clearance requirements will necessitate the removal of such trees during the lifetime of the line. Annual ground reconnaisance by maintenance personnel will temporarily disturb wildlife inhabiting the right-of-way and areas immediately adjacent to access roads.

# 6. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The project's short-term effects on the environment are the land-use disruptions and vegetation modifications occurring mainly during the construction process. These disruptions occur on land cleared of vegetation for access or modified during clearance and maintenance. The disruptions include the cutting of trees, clearing of shrubs and other low growing vegetation, burning and nuisance effects such as noise typical of any construction activity.

During the period of operation of the proposed line some changes in short-term land use may be noted, particularly in certain portions of Networks 1 and 2. The clearing of the corridor may permit easier access to some areas by snowmobile and other recreational vehicles, thus enhancing the recreational use of the area, primarily by hunters. The proposed vegetation management plan (Sec. 2.6.2.2) will improve the habitat quality for wildlife species characteristic of early successional stages.

Long-term uses of the various resources, such as vegetation, soils, wildlife, esthetics and recreation, will be affected by the project in various ways. Climate, air quality, geology and topography in the project area are expected to remain at the same level during the long term as presently existing before construction. The mining of mineral resources such as peat for use as a fuel may occur in the future along portions of and in the vicinity of the corridor, particularly in Network 3 (Fig. 2.1).

The benefit of the proposed 500-kV transmission line relates to the fact that it helps insure an adequate and reliable power supply, thereby contributing to the economic growth or stability and standard of living in those areas it serves. The line provides for an exchange of power between two nations having seasonally different peak demand periods. In strengthening system reliability, the proposed project will help avert projected load deficiencies and the resultant adverse impact to the socioeconomic structure of the supply areas. Construction of the line permits an exchange of power from existing power supply systems as opposed to the construction of new generating capacities by both Manitoba Hydro and the applicant.

# 7. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The commitment of resources will vary in both the degree and the stage at which they occur during implementation of the project. The applicant has utilized engineering and routing methods to the fullest possible extent to reduce resource requirements in tower and conductor construction.

Short-term commitments of resources include labor, gasoline and diesel fuel, brush or timber burned in ROW clearing, and soil losses through erosion. Undetermined quantities of petroleum fuel will be consumed by the heavy equipment utilized in ROW clearing, tower foundation installations, tower erection and conductor stringing. Helicopters used in erecting the guyed towers and the transportation of construction materials to the respective sites will also consume petroleum fuel.

Long-term commitments of nonrenewable resources include the use of aluminum, steel and concrete in meeting structural requirements of the line (Table 7.1). All the materials will be recycled, when the line is abandoned, with the exception of concrete used in the footings for the structures.

Table 7.1. Nonrenewable Resources Utilized in the Construction of Towers, Tower Foundations, and Conductors[a]

| | |
|---|---|
| Steel | |
| Conductor | 1,600 tons |
| Shield wire | 400 tons |
| Foundations | 1,800 tons |
| Guy wires | 200 tons |
| Aluminum | |
| Structures | 4,000 tons |
| Conductors | 4,400 tons |
| Concrete | |
| Foundations | 24,000 cu yd |

[a]Total resources utilized were calculated on the basis of a 200-mi long corridor using the applicant's estimates on quantities of resources required per mile of line. From "Draft Environmental Statement, NSP TR-1," Minn. Environmental Quality Council.

Various quantities of herbicides will be utilized to control vegetative growth along the ROW once construction has been completed. The actual types and quantities of herbicides to be used have not been determined but will be selected from a list approved by the State of Minnesota.

Relatively little modification of land use need occur because of the presence of the line. The maintenance of proper clearance for the ROW requires some modification in land use. The only commitment of land itself occurs directly beneath structure footings and guy wires. This area amounts to 185 acres (74 ha) for the entire transmission line. Once the line is decommissioned the footings will be removed to a minimum of 18 in. (46 cm) below ground level after which they will be covered with soil to provide a substrate suitable for the establishment of natural vegetation.

# 8. ALTERNATIVES TO THE PROPOSED ACTION

Since the proposed project involves the construction and operation of a transmission line, the principal alternative considerations involve only (a) the need for power and alternative methods of obtaining it, and (b) various possible routes for the transmission line. Alternative methods discussed under item (a) are the no-action option, construction of additional generating capacity within the area, alternative voltages for the transmission line, purchase of power from a U.S. source, conservation and rate schedule strategies by the utility, and purchase of surplus power from Manitoba Hydro. Various alternative routes for the transmission line are discussed in Section 8.7.

## 8.1 THE NO-ACTION ALTERNATIVE

In the no-action alternative, the summer peak demand must be met by existing facilities and currently planned additions. Table 8.1 presents the summer and winter peak demands as predicted by the applicant through the year 1987. The staff notes a high winter to summer load factor. The applicant predicts this load factor will decline slightly through the coming decade but will remain high.

In Table 8.2, the staff compares the applicant's summer peak prediction with a 3%, 4%, 5%, and 6% growth. Several national electrical energy forecasts are given in Table 8.3. The applicant's projection falls between the 4% and 5% forecasts and is therefore considered reasonable by the staff.

Table 8.1 also presents a comparison of the estimated load and generating capability data for Northern States Power Company with the 500-MW summer purchase from Manitoba Hydro included. Line 13 indicates the surplus or deficit capacity with the 500-MW purchase and line 14 indicates roughly the situation without the interchange. It appears that the transmission line will not be required until the summer of 1981. However, depending on the duration of the winter freezes during which construction occurs, the transmission line may not be completed by the summer of 1980. Further, some allowance should be given to the possibility of a warmer than usual summer and errors in forecasting. The staff therefore finds the no-action option to be inappropriate.

## 8.2 CONSTRUCTION OF ADDITIONAL GENERATING CAPACITY WITHIN THE AREA

The staff has considered the possible construction of base load oil, base load coal, base load nuclear, oil peaking units, and other energy sources.

### 8.2.1 Base Load Oil

Base load oil is not considered to be a viable alternative in light of national policy to eliminate oil as a boiler fuel.

### 8.2.2 Base Load Coal

The lead time for construction of a coal unit is about eight years. It would not be feasible to complete the coal units planned for 1983 in time to meet the 1980 demand. The capital expenses of coal are higher than for a transmission line and operating costs for the low sulfur coal unit are about the same. Operation of a high sulfur coal unit without scrubbers would be less expensive. The environmental impacts of construction of a coal unit are more spatially concentrated. A transmission line tying the coal unit into the system grid may still be required depending upon the location of the site.

Table 8.1. Estimated Load and Generating Capability for NSP including the 500-MW Summer Purchase from Manitoba Hydro

| | Summer 1978 | Winter 1978 | Summer 1979 | Winter 1979 | Summer 1980 | Winter 1980 | Summer 1981 | Winter 1981 | Summer 1982 | Winter 1982 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 Seasonal system demand | 4,570 | 3,810 | 4,810 | 3,970 | 5,070 | 4,180 | 5,370 | 4,340 | 5,680 | 4,550 |
| 2 Annual system demand | 4,570 | 4,570 | 4,810 | 4,810 | 5,070 | 5,070 | 5,370 | 5,370 | 5,680 | 5,680 |
| 3 Firm purchases - total | 0 | 0 | 0 | 0 | 500 | 0 | 500 | 0 | 500 | 0 |
| 4 Firm sales - total | 229 | 179 | 203 | 364 | 138 | 337 | 49 | 347 | 62 | 356 |
| 5 Seasonal adjusted net demand (1 - 3 + 4) | 4,799 | 3,989 | 5,013 | 4,334 | 4,708 | 4,517 | 4,919 | 4,687 | 5,242 | 4,906 |
| 6 Annual adjusted net demand (2 - 3 + 4) | 4,799 | 4,749 | 5,013 | 5,174 | 4,708 | 5,407 | 4,919 | 5,717 | 5,242 | 6,036 |
| 7 Net generating capability (owned) | 6,189 | 6,613 | 6,189 | 6,658 | 6,189 | 6,613 | 6,189 | 6,658 | 6,189 | 6,567 |
| 8 Participation purchases - total | 29 | 0 | 260 | 0 | 108 | 0 | 0 | 0 | 35 | 0 |
| 9 Participation sales - total | 100 | 84 | 64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 Adjusted net capability (7 + 8 - 9) | 6,118 | 6,529 | 6,385 | 6,658 | 6,297 | 6,613 | 6,189 | 6,658 | 6,224 | 6,567 |
| 11 Net reserve capacity obligation (6 × 15%) | 720 | 712 | 752 | 776 | 706 | 811 | 738 | 858 | 786 | 905 |
| 12 Total firm capacity obligation (5 + 11) | 5,519 | 4,701 | 5,765 | 5,110 | 5,414 | 5,328 | 5,657 | 5,545 | 6,028 | 5,811 |
| 13 Surplus or deficit (-) capacity (10 - 12) | 599 | 1,828 | 620 | 1,548 | 883 | 1,285 | 532 | 1,113 | 196 | 756 |
| 14 Surplus or deficit (-) without the interchange | 99 | 2,128 | 120 | 1,848 | 383 | 1,585 | 32 | 1,413 | (304) | 1,056 |

SUMMER: May 1 - October 31;
WINTER: November 1 - April 30.

Table 8.1. Continued

| | | Summer 1983 | Winter 1983 | Summer 1984 | Winter 1984 | Summer 1985 | Winter 1985 | Summer 1986 | Winter 1986 | Summer 1987 | Winter 1987 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Seasonal system demand | 5,980 | 4,730 | 6,210 | 4,910 | 6,470 | 5,120 | 6,760 | 5,280 | 7,050 | 5,460 |
| 2 | Annual system demand | 5,980 | 5,980 | 6,210 | 6,210 | 6,470 | 6,470 | 6,760 | 6,760 | 7,050 | 7,050 |
| 3 | Firm purchases - total | 500 | 0 | 500 | 0 | 500 | 0 | 500 | 0 | 500 | 0 |
| 4 | Firm sales - total | 75 | 366 | 88 | 374 | 98 | 379 | 105 | 387 | 113 | 393 |
| 5 | Seasonal adjusted net demand (1 - 3 + 4) | 5,555 | 5,096 | 5,798 | 5,284 | 6,068 | 5,499 | 6,365 | 5,667 | 6,663 | 5,853 |
| 6 | Annual adjusted net demand (2 - 3 + 4) | 5,555 | 6,346 | 5,798 | 6,584 | 6,068 | 6,849 | 6,365 | 7,147 | 6,663 | 7,443 |
| 7 | Net generating capability (owned) | 6,878 | 7,340 | 6,872 | 7,147 | 7,427 | 7,891 | 7,427 | 7,890 | 8,205 | 8,605 |
| 8 | Participation purchases - total | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | Participation sales - total | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | Adjusted net capability (7 + 8 - 9) | 6,878 | 7,340 | 6,872 | 7,147 | 7,427 | 7,891 | 7,427 | 7,890 | 8,205 | 8,605 |
| 11 | Net reserve capacity obligation (6 × 15%) | 833 | 952 | 870 | 988 | 910 | 1,027 | 955 | 1,072 | 999 | 1,116 |
| 12 | Total firm capacity obligation (5 + 11) | 6,388 | 6,048 | 6,668 | 6,272 | 6,978 | 6,526 | 7,320 | 6,739 | 7,662 | 6,969 |
| 13 | Surplus or deficit (-) capacity (10 - 12) | 490 | 1,292 | 204 | 875 | 449 | 1,365 | 107 | 1,151 | 543 | 1,636 |
| 14 | Surplus or deficit (-) without the interchange | (-10) | 1,592 | (296) | 1,175 | (-1) | 1,665 | (-393) | 1,451 | 43 | 1,936 |

SUMMER: May 1 - October 31;
WINTER: November 1 - April 30.

Table 8.2. Comparison of Staff and Applicant Predictions of Summer Peak Load

| Year | Applicant | Staff 3% | 4% | 5% | 6% |
|---|---|---|---|---|---|
| 1978 | 4570 | 4638 | 4683 | 4728 | 4773 |
| 1979 | 4810 | 4772 | 4870 | 4964 | 5060 |
| 1980 | 5070 | 4921 | 5065 | 5213 | 5363 |
| 1981 | 5370 | 5068 | 5268 | 5473 | 5683 |
| 1982 | 5680 | 5220 | 5478 | 5747 | 6026 |
| 1983 | 5980 | 5377 | 5698 | 6034 | 6388 |
| 1984 | 6210 | 5538 | 5926 | 6336 | 6771 |
| 1985 | 6470 | 5704 | 6127 | 6653 | 7177 |
| 1986 | 6760 | 5875 | 6409 | 6986 | 7608 |
| 1987 | 7050 | 6052 | 6665 | 7335 | 8064 |

Table 8.3. National Electrical Energy Forecasts[a]

| Source and Year of Study | Projected Growth Rate, % |
|---|---|
| Oak Ridge - 1973 | 4.4 |
| Arthur D. Little - 1974 | 6.4 |
| Lawrence Livermore Lab. - 1974 | 5.6 |
| Hudson Jorgenson - 1974 | 5.5 |
| Technical Advisory Committee - FPC - 1974 | 6.0 |
| Oak Ridge - 1975 | 5.1 |
| Westinghouse - 1975 | 5.0 |
| Electrical World - 1975 | 5.8 |
| Institute for Energy Analysis[b] - 1976 | 4.4-5.5 |
| Fiftieth American Assembly[c] - 1976 | 5.0-5.5 |
| Ebasco[d] | 4.5 |
| NERC[e] | 6.8 |

[a]From "National Energy Outlook," 1976, except as noted.

[b]"Economic and Environmental Implications of a U. S. Nuclear Moratorium, 1985-2010," Vol. 1, Summary, Institute for Energy Analysis, Oak Ridge, Tennessee, September 1976.

[c]"Nuclear Energy," Report of the Fiftieth American Assembly, Arden House, Columbia University, 22-25 April 1976.

[d]EBASCO 1977 Business and Economic Charts, Business and Economic Research Department, Ebasco Services Incorporated.

[e]Based upon summer peak loads, Appendix A-1, "7th Annual Review of Overall Reliability and Adequacy of the North American Bulk Power Systems," Interregional Subcommittee of the Technical Advisory Committee, National Electric Reliability Council, July 1977.

### 8.2.3 Base Load Nuclear

Since the lead time of construction of a nuclear facility is about ten years, the nuclear facility would not be ready until about 1988. While operating costs would be less than the proposed transmission line, capital expenses would be larger. As in the case of coal, environmental impacts of construction would be more concentrated. A transmission line tying the nuclear unit into the system grid may still be required depending upon the location of the site.

### 8.2.4 Peaking Units

Lead time would allow installation of peaking units by 1981. The capital cost would be about the same or less, but operation of the peaking unit would be about twice as expensive as the purchase power over the proposed transmission line. Further, a peaking unit would increase oil consumption, in conflict with national policy and goals. Construction impacts on the environment are more concentrated for a peaking unit and construction and operational impacts of the transmission line would be less than for the oil peaking unit. Normally, the peaking unit would not require as much transmission line addition as the base load alternatives for system tie-in, but some transmission line construction may be required.

### 8.2.5 Other Technologies

#### 8.2.5.1 Solar and Wind Power

The U. S. Energy Research and Development Administration, now the Department of Energy (DOE), has initiated a research and development program that may lead to commercialization of several types of generating plants deriving their energy directly from the sun or indirectly from wind or ocean thermal gradients. However, the DOE plan is expected to achieve a nationwide level of power production from wind energy by 1985 equivalent to only one or two nuclear units. For the solar alternatives, only small demonstration plants will be achieved prior to 1985.

#### 8.2.5.2 Natural Gas

Although highly desirable as a fuel from the environmental standpoint, natural gas is now in short supply and will be more so in the future. Accordingly, for reasons of practicality and public interest, new industrial consumption of this valuable fuel should be avoided.

#### 8.2.5.3 Geothermal

Geothermal resources are classified by the U. S. Geological Survey according to their potential values. "Known Geothermal Resource Areas" (KGRAs) in the United States are located in 14 western states. Not one is recognized within the applicant's area.

#### 8.2.5.4 Petroleum Liquids

In view of the uncertain supply of imported oil (over one-third of U. S. consumption), and the importance of petroleum as motor-vehicle fuel and as petrochemical feedstock, the staff believes it desirable that new industrial uses be avoided.

#### 8.2.5.5 Advanced Nuclear Sources

Two advanced nuclear energy sources are the breeder reactor and the controlled thermonuclear reactor. Scientific feasibility of the latter has not yet been demonstrated. A demonstration breeder reactor plant is now in the design stage, but more than a decade will be required to construct and operate the breeder to demonstrate commercial feasibility. Therefore, neither a breeder reactor nor a controlled thermonuclear reactor is a practical source for commercial power needed in the early 1980's.

#### 8.2.5.6 Hydroelectric Power

No undeveloped hydro sites of substantial potential for base load operation exist within the NSP system. The development of many low-potential sites would be uneconomical and of uncertain feasibility because of environmental restrictions.

8.2.5.7 Municipal Solid Wastes

The burning of municipal wastes (mixed with coal) as powerplant fuel has been demonstrated successfully and several utilities are now undertaking programs to exploit this fuel. The staff considers this fuel as a supplement to coal rather than a distinct alternative.

## 8.3 ALTERNATE VOLTAGES

A 765-kV transmission line is not needed for the carrying capability of the proposed line and could not be tied into the existing substations of either Manitoba or NSP. The impact of this alternative would be greater since substations would also have to be constructed. The construction of a 345-kV and 230-kV line would require larger ROW sizes and more tower and conductor materials. The environmental impacts of a DC line are about the same but the economics are not as favorable.

## 8.4 POWER PURCHASED FROM A U.S. SOURCE

Other utilities in the area are also summer peaking. Even if NSP could purchase power during the summer, they could not recover costs during the winter. Table 8.4 shows the estimated Load and Generating Capability Data--as committed from the Mid-Continent Area Power Pool. Beyond 1983, it would be very difficult for NSP to purchase 500 MW to meet their summer demand.

## 8.5 EFFECT OF CONSERVATION AND RATE SCHEDULE STRATEGIES UPON ELECTRICAL DEMAND

The effects of energy conservation and rate schedule strategies upon summer peak load expected by NSP are exhibited in Table 8.5.

During 1974, NSP established a residential attic reinsulation program for its customers. It is estimated that this program has influenced the reinsulation of 165,000 homes in their service area since its implementation. Up to one-third of commercial and industrial customers have reinsulated their buildings in varying degrees to date. The reinsulation program has saved 14,094 MWh in cooling energy and reduced the NSP summer peak demand by 10.2 MW.

An energy information service, "Ask NSP," was established in September 1977 by NSP.

In 1965, NSP had 53,436 street lighting units, of which only 1,426 were energy efficient HID (mercury) lamps. As of December 31, 1976, NSP had 77,441 units on line and of these, less than 1,000 incandescent and fluorescent units remain. Awards are given annually to an architectural and consulting engineering firm which has demonstrated extraordinary concern for energy conservation in building and/or system design. NSP has developed an Energy Efficient Home Award Program for all single family dwellings.

NSP initiated the Interruptible Large General Service Rate in April of 1976. The rate is designed to limit on-peak use of energy for new or substitute loads and has a time-of-day feature that provides further incentive to utilize energy during off-peak hours. NSP has co-sponsored a series of energy management workshops for commercial, industrial, and institutional customers at regional locations throughout the service area. NSP has co-sponsored the Minnesota Energy Conference for the past three years. NSP also co-sponsored the Energy Savers Show during September 1977.

NSP is participating with Minnesota Public Service Commission in pilot demonstration projects to implement utility conservation programs directed toward actual implementation of cost-based rates, load management, and end-use activities. Marginal cost pricing for electric utility service and incremental volumetric pricing for gas utility service will be given particular attention.

For the future, the attic reinsulation and ventilation program will be continued and expanded. A program will be developed for making industrial and commercial buildings more energy efficient. The Energy Efficient Home program will be continued. The program of assisting commercial and industrial customers with energy surveys will be continued. A recently completed marketing information index will be used for the identification of load management potential based on customer product usage patterns as affected by potential rate applications, for the identification of conservation based on process redesign, and for the identification of potential substitution loads.

Two competing factors, conservation and substitution, must be considered in arriving at a correct demand for electricity. Conservation of energy of all types, including electricity, has already occurred to some extent. Inasmuch as oil and natural gas are in scarce supply compared with

Table 8.4. Estimated Load and Generating Capability Data--as Committed Mid-Continent Area Power Pool (MW)

| | | Summer 1978 | Winter 1978 | Summer 1979 | Winter 1979 | Summer 1980 | Winter 1980 | Summer 1981 | Winter 1981 | Summer 1982 | Winter 1982 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Seasonal system demand | 18,306 | 16,450 | 19,466 | 17,536 | 20,593 | 18,659 | 21,879 | 19,765 | 23,118 | 20,846 |
| 2 | Annual system demand | 18,833 | 18,997 | 19,854 | 20,212 | 21,034 | 21,458 | 22,322 | 22,783 | 23,636 | 24,038 |
| 3 | Firm purchases - total | 1,691 | 1,270 | 1,211 | 1,244 | 1,802 | 1,057 | 1,701 | 991 | 1,699 | 987 |
| 4 | Firm sales - total | 1,725 | 1,482 | 1,582 | 1,617 | 1,354 | 1,443 | 1,211 | 1,492 | 1,129 | 1,405 |
| 5 | Seasonal adjusted net demand (1 - 3 + 4) | 18,340 | 16,662 | 19,837 | 17,909 | 20,145 | 19,045 | 21,389 | 20,266 | 22,548 | 21,264 |
| 6 | Annual adjusted net demand (2 - 3 + 4) | 18,867 | 19,209 | 20,225 | 20,585 | 20,586 | 21,844 | 21,832 | 23,284 | 23,066 | 24,456 |
| 7 | Net generating capability (owned) | 21,849 | 23,698 | 24,219 | 25,495 | 25,133 | 26,442 | 26,958 | 28,183 | 27,411 | 28,373 |
| 8 | Participation purchases - total | 1,868 | 1,647 | 1,948 | 1,470 | 1,814 | 1,481 | 1,367 | 1,252 | 1,295 | 1,240 |
| 9 | Participation sales - total | 1,269 | 1,256 | 1,900 | 1,455 | 1,835 | 1,393 | 1,281 | 1,216 | 1,260 | 1,205 |
| 10 | Adjusted net capability (7 + 8 - 9) | 22,448 | 24,089 | 24,267 | 25,510 | 25,112 | 26,530 | 27,044 | 28,219 | 27,446 | 28,408 |
| 11 | Net reserve capacity obligation (6 × 15%) | 2,715 | 2,783 | 2,934 | 2,989 | 2,987 | 3,176 | 3,172 | 3,393 | 3,357 | 3,567 |
| 12 | Total firm capacity obligation (5 + 11) | 21,055 | 19,445 | 22,771 | 20,898 | 23,132 | 22,221 | 24,561 | 23,659 | 25,905 | 24,831 |
| 13 | Surplus or deficit (-) capacity (10 - 12) | 1,393 | 4,644 | 1,496 | 4,612 | 1,980 | 4,309 | 2,483 | 4,560 | 1,541 | 3,577 |

SUMMER: May 1 - October 31;
WINTER: November 1 - April 30.

Table 8.4. Continued

| | Summer 1983 | Winter 1983 | Summer 1984 | Winter 1984 | Summer 1985 | Winter 1985 | Summer 1986 | Winter 1986 | Summer 1987 | Winter 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 Seasonal system demand | 24,407 | 22,136 | 25,765 | 23,542 | 27,201 | 24,933 | 28,684 | 26,412 | 30,032 | 27,879 |
| 2 Annual system demand | 24,904 | 25,463 | 26,294 | 26,942 | 27,779 | 28,421 | 29,332 | 30,011 | 30,806 | 31,588 |
| 3 Firm purchases - total | 1,690 | 986 | 1,687 | 985 | 1,685 | 986 | 1,684 | 989 | 1,670 | 976 |
| 4 Firm sales - total | 1,145 | 1,422 | 1,162 | 1,435 | 1,177 | 1,446 | 1,193 | 1,462 | 1,204 | 1,470 |
| 5 Seasonal adjusted net demand (1 - 3 + 4) | 23,862 | 22,572 | 25,240 | 23,992 | 26,693 | 25,393 | 28,193 | 26,885 | 29,566 | 28,373 |
| 6 Annual adjusted net demand (2 - 3 + 4) | 24,359 | 25,899 | 25,769 | 27,392 | 27,271 | 28,881 | 28,841 | 30,484 | 30,340 | 32,082 |
| 7 Net generating capability (owned) | 28,781 | 30,012 | 29,188 | 29,818 | 30,098 | 30,892 | 30,073 | 30,840 | 30,820 | 31,941 |
| 8 Participation purchases - total | 1,308 | 1,230 | 1,120 | 1,120 | 1,110 | 1,110 | 1,200 | 1,200 | 1,200 | 1,200 |
| 9 Participation sales - total | 1,207 | 1,197 | 1,089 | 1,089 | 1,080 | 1,080 | 1,072 | 1,072 | 1,052 | 1,052 |
| 10 Adjusted net capability (7 + 8 - 9) | 28,882 | 30,046 | 29,219 | 29,849 | 30,128 | 30,922 | 30,201 | 30,968 | 32,968 | 32,089 |
| 11 Net reserve capacity obligation (6 × 15%) | 3,552 | 3,786 | 3,766 | 4,010 | 3,988 | 4,231 | 4,223 | 4,471 | 4,448 | 4,709 |
| 12 Total firm capacity obligation (5 + 11) | 27,414 | 25,358 | 29,006 | 28,002 | 30,681 | 29,624 | 32,416 | 31,356 | 34,014 | 33,082 |
| 13 Surplus or deficit (-) capacity (10 - 12) | 1,468 | 3,687 | 213 | 1,847 | -553 | 1,298 | -2,215 | -388 | -3,046 | -993 |

SUMMER: May 1 - October 31;
WINTER: November 1 - April 30.

Table 8.5. Expected Effects of Energy Conservation and Rate Schedule Strategy Programs upon Summer Peak (MW)

| | Year | | | |
|---|---|---|---|---|
| Program Name | 1979 | 1980 | 1985 | 1988 |
| Residential attic reinsulation | 21 | 26 | 35 | 37 |
| Energy efficient home | < 1 | < 1 | 5 | 10 |
| Conferences, seminars and workshops | 2 | 4 | 14 | 20 |
| Energy consultation (surveys) | 20 | 41 | 71 | 77 |
| Load management rates | | 3 | 95 | 113 |
| Load management control system | | | 70 | 237 |
| Miscellaneous programs (includes paid communications) | 78 | 78 | 80 | 80 |
| Total programs | 121 | 152 | 370 | 576 |

electricity, residential and industrial customers alike are converting from gas or oil to electricity. Since the November 1973 oil embargo, there has been some evidence of conservation in the United States. About 30% of the summer peak of NSP is due to weather sensitive effects. Therefore, programs underway to minimize heating and cooling will help reduce both the summer and winter peaks. At this time, it is difficult to estimate how effective the NSP conservation programs will be and how much of the conservation already recorded is due to electrical price elasticity effects. The staff feels that the current NSP forecast adequately reflects conservation and properly plans for electrical energy demand for at least the next half decade.

It is still too early to judge the extent to which time-differential rates will be effective in improving load factors in the U. S. and in the NSP region. Since NSP has a high load factor, any peak-load pricing formulation might not be as effective as would be the case with utilities having lower load factors. The staff notes that it is difficult to judge the time of a decision to implement such rates, whether such rates would be implemented with ease, and how much time would elapse before a response might occur--if at all.

The applicant has interruptible power contracts that are available to and being utilized by industrial customers. The applicant uses the provisions of the interruptible load contracts to shave peaks as a conservation measure. The staff has no basis to estimate the future amount of interruptible power contracts that would be signed by NSP customers.

Load staggering is a technique that has received some attention as a possible conservation measure. Basically, this alternative involves shifting the work hours of industrial or commercial firms to avoid diurnal or weekday peaks. In general, interference with customer and worker preferences as well as productive efficiencies make the desirability, if not the feasibility, of such proposals questionable. The staff does not believe that interruptible load contracts and load staggering are effective energy-conservation measures at assumed-constant industrial output.

NSP forecasts a 7% peak load reduction by 1987 through the conservation and load management activities it has voluntarily initiated. This savings estimate is consistent with DOE's assessment of the impact of the proposed National Energy Act, reflecting the fact that NSP is already moving forward on several of the key initiatives to be required by the Act. In short, the utility's estimate of peak load reduction is both considerable and reasonable.

## 8.6 MANITOBA HYDRO AS A SOURCE OF SUMMER INTERCHANGE

Table 8.6 indicates the ability of Manitoba Hydro to provide power to NSP during the summers of the 1980's. The amount of surplus power indicates the desirability of the interchange. Further, the utilization of hydroelectric power is environmentally sound.

Table 8.6. Comparison of Power Capability, Demand, and Surplus for Manitoba Hydro for the Month of July (MW)

| | Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
| Generating Capability | 4033 | 4033 | 4033 | 4033 | 4618 | 4969 | 4760 | 4976 |
| Demand | | | | | | | | |
| Manitoba | 2020 | 2159 | 2313 | 2477 | 2644 | 2826 | 3019 | 3200 |
| Firm Sales[a] | 2720 | 2809 | 2813 | 2977 | 3144 | 3326 | 3519 | 3700 |
| Desired Reserve | 326 | 337 | 338 | 357 | 377 | 399 | 422 | 444 |
| Required Capability | 3046 | 3146 | 3151 | 3334 | 3521 | 3725 | 3941 | 4144 |
| Surplus | 987 | 887 | 882 | 699 | 1097 | 1244 | 1262 | 1266 |

Source: Table 9R, Vol. 5, Application to the National Energy Board for a Certificate of Public Convenience and Necessity for an International Power Line and Licenses to Export Power and Energy, Manitoba Hydro Electric Board, Manitoba, 1977.

[a]Includes 500 MW sale to NSP.

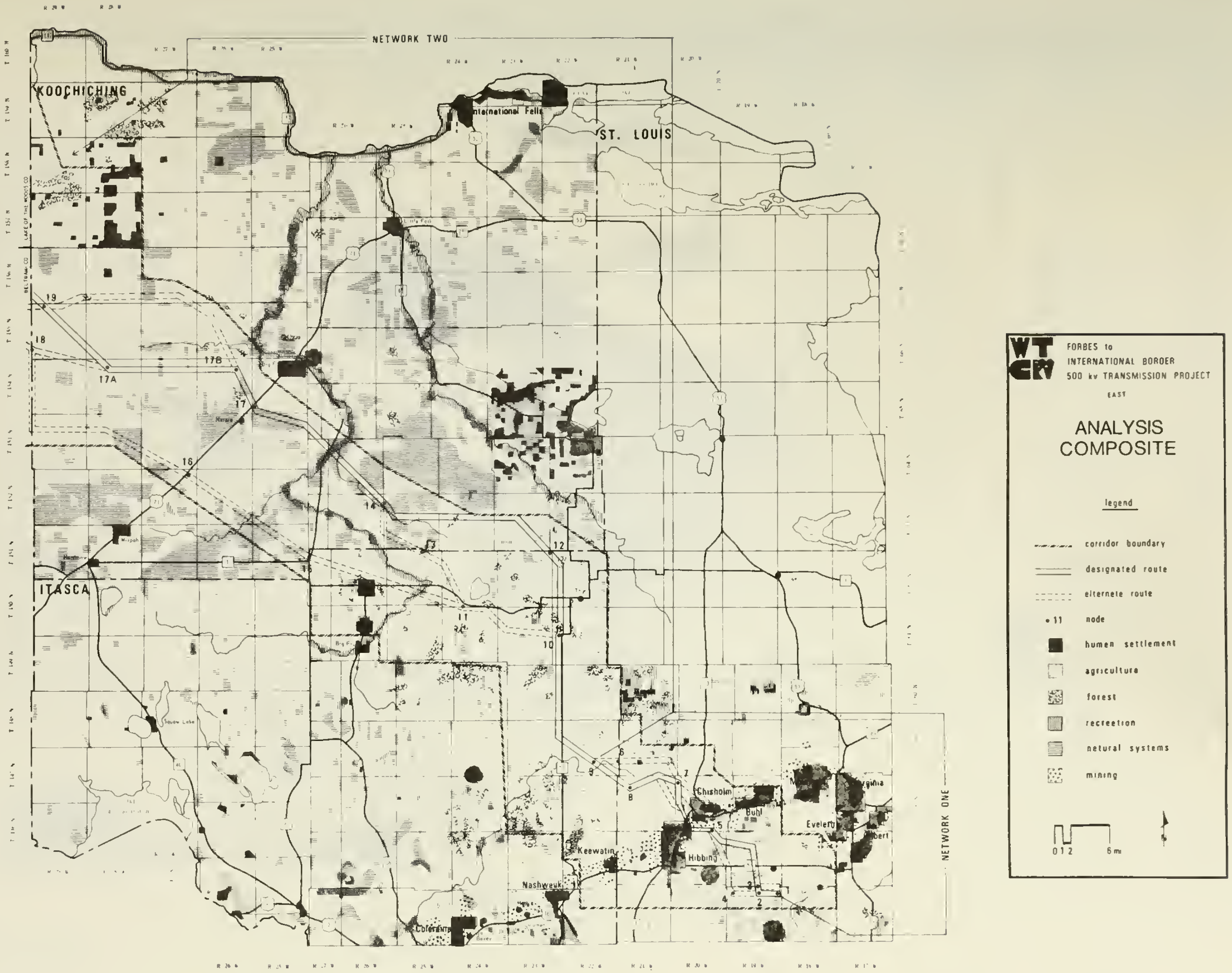


Fig. 8.1. Composite Map Showing Sensitive Areas for Networks 1 and 2. From ER, Fig. 3.3-6.

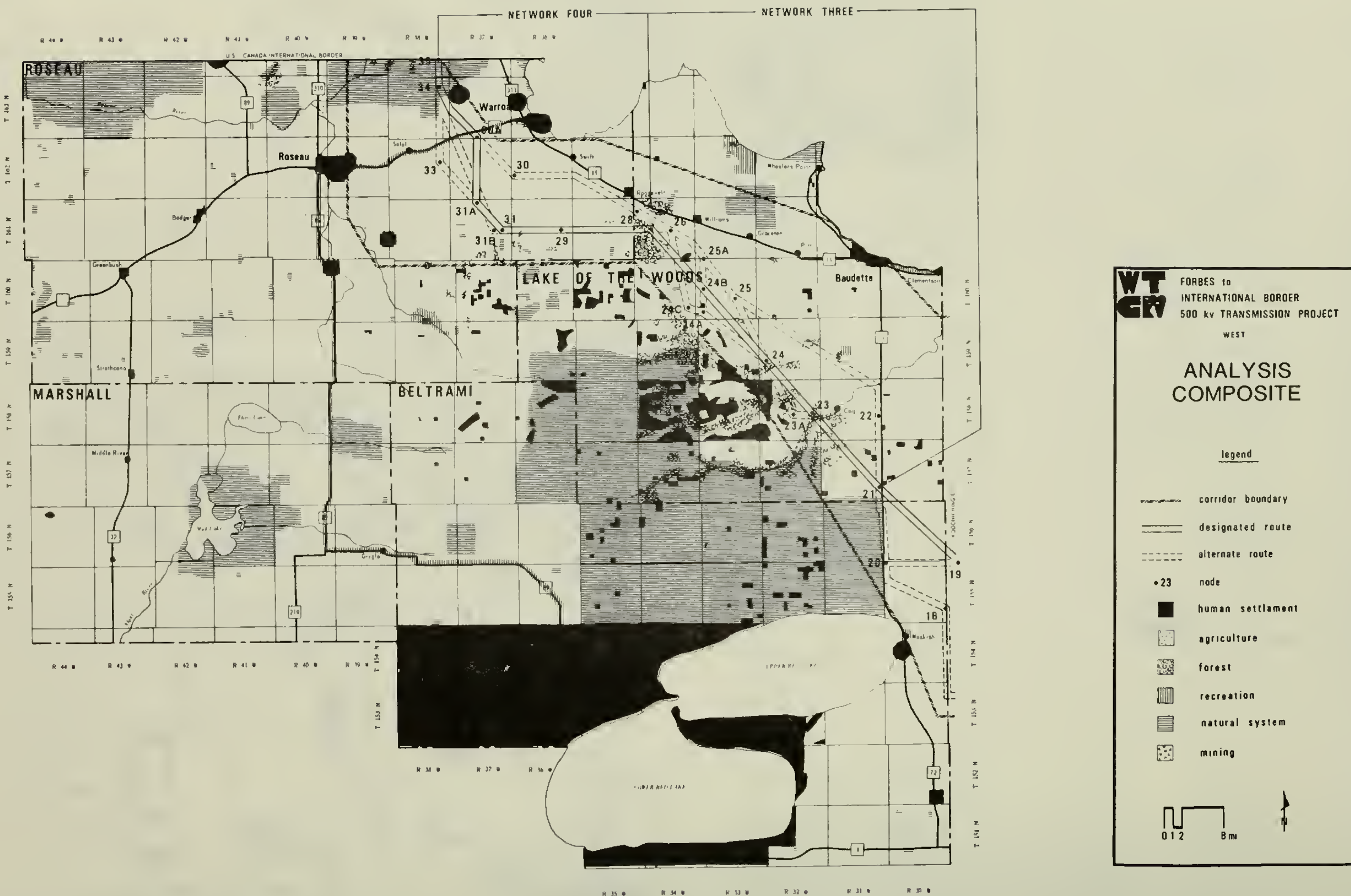


Fig. 8.2. Composite Map Showing Sensitive Areas for Networks 3 and 4. From ER, Fig. 3.3-6a.

Table 8.7. Summary of Potential Impacts--Network 1

| Impact | ROUTE 1 | ROUTE 2 (NSP Pref.) | ROUTE 3 | ROUTE 4 | ROUTE 5 | ROUTE 6 | ROUTE 7 | ROUTE 8 (CREC Pref.) (DNR Pref.) |
|---|---|---|---|---|---|---|---|---|
| HUMAN SETTLEMENT | | | | | | | | |
| Homes within: | | | | | | | | |
| 0-500' of centerline | 10 | 11 | 23 | 4 | 5 | 17 | 5 | 11 |
| 0-1000' of centerline | 25 | 36 | 56 | 20 | 23 | 55 | 22 | 25 |
| 0-1500' of centerline | 37 | 38 | 89 | 40 | 43 | 98 | 42 | 37 |
| Route | 49 | 71 | 128 | 48 | 70 | 107 | 57 | 56 |
| 500' of route | 61 | 86 | 165 | 70 | 95 | 154 | 72 | 71 |
| Miles of route within 1500' of urban area | 0.0 | 1.2 | 0.6 | 0.0 | 1.2 | 0.6 | 0.6 | 0.6 |
| FORESTRY | | | | | | | | |
| Miles through | 26.7 | 25.5 | 28.1 | 27.1 | 25.7 | 28.2 | 27.8 | 27.9 |
| Acres Impacted | 509 | 482 | 556 | 511 | 484 | 559 | 523 | 524 |
| % of route | 62% | 57% | 63% | 62% | 57% | 63% | 62% | 62% |
| AGRICULTURE | | | | | | | | |
| Miles through | 0.8 | 0.7 | 1.5 | 1.5 | 1.4 | 2.2 | 0.7 | 1.4 |
| Acres impacted | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.1 | 0.2 |
| RECREATION | | | | | | | | |
| Miles of line within 1/4 mile of lake | 28.75 Carey Lake | 29.7 Interpretive Center Carey Lake | 20 Carey Lake | 31.3 McQuade Lake | 37.3 Interpretive Center McQuade Lake | 22.6 McQuade Lake | 29.7 Carey Lake | 32.3 McQuade Lake |
| EXTRACTIVE RESOURCES | | | | | | | | |
| Crosses mineral lands | Yes | | Yes | Yes | | Yes | | Yes |
| Proposed water reservoir | Yes | | | Yes | Yes | | | Yes |
| COST | | | | | | | | |
| Increment over low cost route | 5,000 | 290,000 | 235,000 | 0 | 285,000 | 300,000 | 0 | 0 |
| OTHER | Airport | Airport | Communication Facility Airport | | | Communication Facility | Airport | |

Table 8.8. Summary of Potential Impacts--Network 2

| Impact | ROUTE 1 | ROUTE 2 | ROUTE 3 | ROUTE 4 | ROUTE 5 | ROUTE 6 | ROUTE 7 | ROUTE 8 (CREC Pref.) (DNR Pref.) | ROUTE 9 (NSP Alt.) | ROUTE 10 | ROUTE 11 (NSP Pref.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HUMAN SETTLEMENT | | | | | | | | | | | |
| Homes within: | | | | | | | | | | | |
| 0-500' of centerline | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0-1000' of centerline | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 8 |
| 0-1500' of centerline | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 11 |
| Route | 6 | 6 | 6 | 6 | 4 | 4 | 4 | 4 | 4 | 4 | 15 |
| 500' of route | 7 | 7 | 7 | 7 | 4 | 4 | 4 | 4 | 4 | 4 | 19 |
| FORESTRY | | | | | | | | | | | |
| Miles through | 42.2 | 40.8 | 40.8 | 45.7 | 45.7 | 44.7 | 43.2 | 43.2 | 54.0 | 52.7 | 45.0 |
| Acres impacted | 928 | 899 | 899 | 1007 | 1007 | 894 | 865 | 865 | 1081 | 1054 | 991 |
| % of route | 48% | 46% | 48% | 51% | 54% | 50% | 48% | 48% | 59% | 60% | 52% |
| AGRICULTURE | | | | | | | | | | | |
| Miles through | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.25 |
| Acres impacted | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.2 |
| Fields crossed | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| RECREATION | | | | | | | | | | | |
| Line miles within 1500' of lakes | 2.25 (Deer Lk. area) | 2.25 (Deer Lk. area) | 2.25 | 2.25 | 2.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 2 (Deer Lk. area) |
| RIGHT-OF-WAY SHARING | 0 | 0 | 0 | 0 | 0 | 29.5 | 29.5 | 29.5 | 29.5 | 29.5 | 0 |
| ACCESS | | | | | | | | | | | |
| Poor access | 4 | 6 | 5 | 2 | 3 | 4 | 6 | 5 | 2 | 3 | |
| Bog further than 1/9 mile from road | 28 | 35 | 38 | 16 | 19 | 28 | 35 | 38 | 16 | 19 | 6 |
| COST INCREMENT | 1,950,000 | 2,450,000 | 1,750,000 | 1,250,000 | 1,450,000 | 2,500,000 | 3,000,000 | 2,300,000 | 1,800,000 | 2,000,000 | 0 |
| OTHER | | | | PORTER | | RIDGE | TRAIL | | | | Gemmel Trail Caldwell Trail |

Table 8.9. Summary of Potential Impacts--Network 3

| Impact | ROUTE 1 (DNR Pref) | ROUTE 2 (NSP Pref) | ROUTE 3 | ROUTE 4 | ROUTE 5 | ROUTE 6 | ROUTE 7 | ROUTE 8 (CREC Pref) | ROUTE 9 (NSP Alt) | ROUTE 10 | ROUTE 11 | ROUTE 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HUMAN SETTLEMENT | | | | | | | | | | | | |
| Homes within: | | | | | | | | | | | | |
| 0-500' of centerline | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 0-1000' of centerline | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 2 |
| 0-1500' of centerline | 8 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 3 |
| Route | 8 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 3 |
| 500' of route | 8 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 3 |
| AGRICULTURE | | | | | | | | | | | | |
| Miles through | 2.7 | 1.2 | 1.2 | 1.0 | 1.0 | 0.6 | 0.6 | 0.2 | 0.7 | 0.7 | 0.3 | 0.3 |
| Acres | 0.8 | 0.4 | 0.4 | 0.3 | 0.3 | 0.2 | 0.2 | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 |
| % of route | 7.7 | 3.7 | 3.6 | 3.0 | 2.9 | 1.8 | 1.7 | 0.5 | 2.1 | 2.0 | 0.8 | 0.8 |
| Fields crossed | | | | | | | | | | | | |
| Cultivated | 13 | 7 | 7 | 8 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| Pasture | 7 | 3 | 3 | 5 | 4 | 3 | 3 | 2 | 2 | 1 | 1 | 1 |
| FORESTRY | | | | | | | | | | | | |
| Miles through | 23 | 25 | 25 | 23 | 24 | 22 | 23 | 23 | 24 | 24 | 24 | 25 |
| Acres cleared | 482 | 482 | 508 | 469 | 496 | 464 | 471 | 507 | 505 | 525 | 521 | 536 |
| Acres aspen/spruce | 333 | 318 | 298 | 297 | 297 | 242 | 295 | 331 | 387 | 387 | 385 | 385 |
| % of route | 66 | 77 | 75 | 69 | 71 | 66 | 67 | 67 | 72 | 60 | 71 | 72 |
| ACCESS | | | | | | | | | | | | |
| Wetland more than 1/4 mile from road | 2.0 | 7.0 | 8.0 | 8.5 | 9.5 | 11.0 | 12.0 | 13.5 | 8.5 | 9.5 | 11.0 | 8.5 |
| RIGHT-OF-WAY SHARING | 9.9 | 9.9 | 9.9 | 4.5 | 4.5 | 4.5 | 4.5 | 0 | 0 | 0 | 0 | 0 |
| COST INCREMENT | 475,000 | 380,000 | 1,680,000 | 630,000 | 1,150,000 | 740,000 | 1,080,000 | 1,300,000 | 0 | 340,000 | 590,000 | 680,000 |

Table 8.10. Summary of Potential Impacts--Network 4

| Impact | ROUTE 1 (NSP Pref.) (DNR Pref.) | ROUTE 2 | ROUTE 3 | ROUTE 4 (CREC Pref.) | ROUTE 5 (NSP Alt.) | ROUTE 6 | ROUTE 7 | ROUTE 8 |
|---|---|---|---|---|---|---|---|---|
| HUMAN SETTLEMENT | | | | | | | | |
| Homes within: | | | | | | | | |
| 0-500' of centerline | 3 | 6 | 7 | 2 | 3 | 6 | 7 | 2 |
| 0-1000' of centerline | 11 | 12 | 14 | 7 | 11 | 12 | 14 | 7 |
| 0-1500' of centerline | 27 | 18 | 19 | 11 | 27 | 18 | 19 | 11 |
| Route | 27 | 20 | 21 | 14 | 27 | 20 | 21 | 14 |
| 500' of route | 35 | 30 | 25 | 21 | 35 | 30 | 25 | 21 |
| AGRICULTURE | | | | | | | | |
| Miles through | 12.5 | 5.5 | 5.9 | 5.6 | 12.5 | 5.5 | 5.9 | 5.6 |
| Acres | 4 | 1.7 | 1.8 | 1.8 | 4.0 | 1.7 | 1.8 | 1.8 |
| % of route | 41 | 16 | 17 | 16 | 43 | 17 | 18 | 17 |
| Fields crossed | | | | | | | | |
| Cultivated | 62 | 25 | 24 | 24 | 62 | 25 | 24 | 24 |
| Pasture | | 2 | 5 | 6 | | 2 | 5 | 6 |
| FORESTRY | | | | | | | | |
| Miles through | 15.2 | 25.2 | 23.5 | 23.8 | 14.4 | 23.9 | 22.2 | 22.5 |
| Acres cleared | 274 | 539 | 509 | 521 | 261 | 505 | 479 | 488 |
| Acres of aspen/spruce | 152 | 317 | 346 | 322 | 148 | 305 | 333 | 309 |
| % of route | 51 | 73 | 68 | 69 | 50 | 73 | 68 | 69 |
| RIGHT-OF-WAY SHARING | | | | | | | | |
| Miles | 30 | 4 | 4 | 8.25 | 25.5 | 4 | 4 | 8.25 |
| COST INCREMENT | 335,000 | 1,445,000 | 1,445,000 | 1,535,000 | 0 | 950,000 | 950,000 | 1,040,000 |

## 8.7 ALTERNATIVE ROUTES FOR THE TRANSMISSION LINE

The applicant followed a number of steps in analyzing the various possible transmission line routes, each successive step involving a finer degree of resolution of the matters of concern. The final result was a composite network map (Figs. 8.1 and 8.2) that shows sensitive areas relating to the following topics of concern; human settlements, agriculture, forest, recreation, natural systems, and mining. Not all of these activities were present in each of the four networks which make up the proposed line, and Tables 8.7 to 8.10 summarize the potential impacts in each of the four networks.[1]

The federal authority with respect to a Presidential Permit allows DOE to either approve or reject the application for the proposed line. The selection of a line route is under state control. This section evaluates the adequacy of the route selection process used by both the applicant and the state. This process has provided a sufficient number of alternatives for route selection and, therefore, consideration of a new route within an existing corridor, or a new corridor was not deemed necessary.

Data gathering was based on criteria established by the state Power Plant Siting Act (ER, App. C) as well as the recommendation of the ad hoc Technical Routing Review Committee (TRRC). The data were then assembled and critical land-use categories were resolved by the TRRC into 40-acre (16-ha) parcels. Over 40 data maps were developed (ER, Table 3.1-4) and combined to produce the composite mosaic. The degree of impact was assigned to one of five arbitrary impact ranks called "levels of constraint" (ER, Sec. 3.2). After the gray-tone maps were assembled, it was decided that only the highest constraint classes would be combined to form the mosaic analysis found in Figures 8.1 and 8.2. The combination of the two is referred to as the "composite constraint map" (ER, p. 3.2-2).

The applicant developed one preferred route and two alternate routes using the composite constraint map, and within the four networks developed a series of links and nodes (Fig. 8.3) incorporating the following requirements:

1. All links in the network must avoid areas of major constraint on the composite map wherever possible.

2. Access required for construction and maintenance must be available.

3. From land-use and environmental standpoints, discrete alternative routes must exist within the network. In other words, the network must supply decision makers with clear alternatives in choosing the proper balance of impacts on the land (ER, p. 3.2-2).

The next phase of route selection included review of the alternatives by a committee of citizens from northern Minnesota. Their routing recommendation, plus a detailed rationale,[2] was submitted to the Minnesota Environmental Quality Board (EQB) after four months of deliberation (ER, 3.3-1). This report, along with the transcripts from the twelve public hearings held throughout northeastern Minnesota, was used by the EQB in deciding on the designated route.

The report of the route evaluation committee NSP-TR-1[2] connected the following nodes from northwest at the international border southeast to Forbes substation: 35-34-30A-31A-31-29-27-26-24C-24A-24-23A-21-19-17A-17B-17-14-12-10-9-8-7-5A-5-3-2-1 (Fig. 8.3).[2,3] This route differs from one preferred by the applicant almost totally in Networks 2 and 4. The route in Network 1 is virtually identical with that preferred by the applicant, while Network 3 is the most highly hybridized, containing elements of all three route alternatives.

Due to inaccuracies in the data discovered after the route selection process was complete, the EQB required the applicant to apply for a minor route alteration in the area where the proposed line will cross the border (ER Supp., Resp. to Q. 34.3 30, 75). In June 1977, a hearing was held on this portion of the route and, as a result, the EQB altered the last ten miles of the proposed line. The net result moved the line 1.5 miles west at the point of the border crossing.[4,5]

The staff has reviewed the above-cited information as well as Chapter 6 of the Draft Environmental Impact Statement filed by the Minnesota Environmental Quality Council,[6] and finds the following:

1. Network 1 offers eight routing alternatives between Nodes 1 and 10 (Table 8.11). The potential impacts are related mainly to the proximity of human settlements and extraction of taconite (Table 8.7), but the staff believes these are minimized by the proposed route. Impacts to the agriculture and high-quality timber in this rework are minimal.

2. Network 2 connects Nodes 10 to 21 and contains 11 routing alternatives (Table 8.11). The staff prefers the route designated by the EQB because it avoids Deer Lake recreational area and crosses the Big Fork River well below Little American Falls and associated rapids (Table 8.8). While special problems are posed due to bog construction in this network, the staff is satisfied that the impacts along this route will be uniformly short-term and reversible.

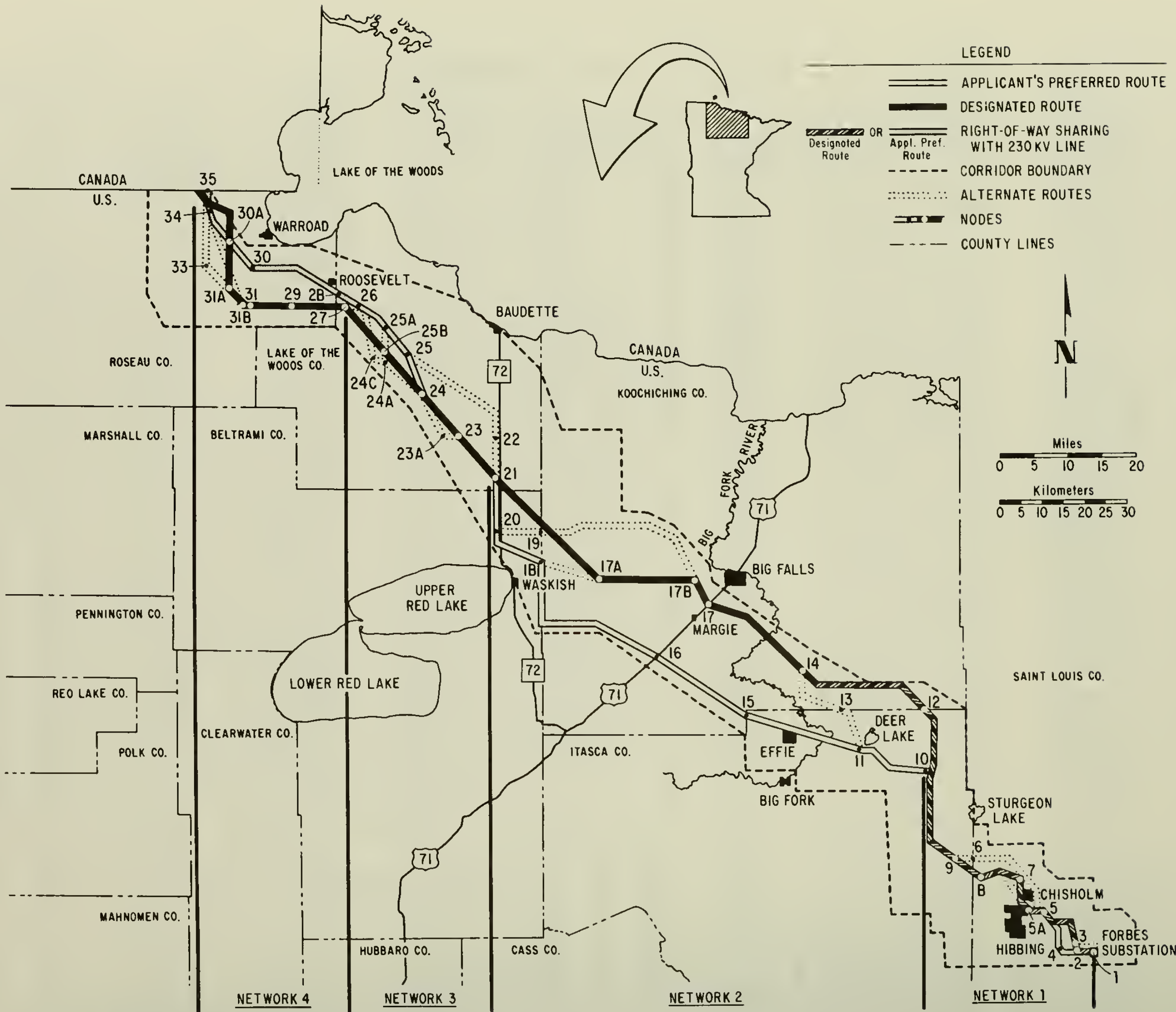


Fig. 8.3. Designated and Alternative Routes for the Proposed Forbes-International Border 500-kV Transmission Line.

Table 8.11. Routing Alternatives Considered by the Route Selection Committee, NSP-TR-1 for the Forbes-International Border Project

**Network 1**

| Route | Nodes | Length |
|---|---|---|
| 1 | 1 2 4 5 8 9 10 | 43.4 |
| 2 (NSP Pref) | 1 2 4 5 7 8 9 10 | 44.7 |
| 3 | 1 2 4 5 6 9 10 | 44.5 |
| 4 | 1 3 5 8 9 10 | 43.5 |
| 5 | 1 3 5 7 8 9 10 | 44.8 |
| 6 | 1 3 5 6 9 10 | 44.6 |
| 7 | 1 2 4 5 5A 7 8 9 10 | 45.2 |
| 8 (CREC Pref) | 1 2 3 5 5A 7 8 9 10 | 45.3 |

**Network 2**

| Route | Nodes | Length |
|---|---|---|
| 1 | 10 11 13 14 17 17B 17A 18 20 21 | 87.0 |
| 2 | 10 11 13 14 17 17B 17A 19 20 21 | 87.5 |
| 3 | 10 11 13 14 17 17B 17A 19 21 | 83.5 |
| 4 | 10 11 13 14 17 17B 19 20 21 | 88.5 |
| 5 | 10 11 13 14 17 17B 19 21 | 84.5 |
| 6 | 10 12 14 17 17B 17A 18 20 21 | 89.0 |
| 7 | 10 12 14 17 17B 17A 19 20 21 | 89.5 |
| 8 (CREC Pref) | 10 12 14 17 17B 17A 19 21 | 85.5 |
| 9 | 10 12 14 17 17B 19 20 21 | 90.5 |
| 10 | 10 12 14 17 17B 19 21 | 86.5 |
| 11 (NSP Pref) | 10 11 15 16 18 20 21 | 86.0 |

**Network 3**

| Route | Nodes | Length |
|---|---|---|
| 1 (DNR Pref) | 21 22 25 25A 26 | 34.8 |
| 2 (NSP Pref) | 21 23 24 25 25A 26 | 32.1 |
| 3 | 21 23 23A 24 25 25A 26 | 32.9 |
| 4 | 21 23 24 24B 25A 26 | 33.0 |
| 5 | 21 23 23A 24 24B 25A 26 | 33.8 |
| 6 | 21 23 24 24A 24B 25A 26 | 33.2 |
| 7 | 21 23 23A 24 24A 24B 25A 26 | 34.0 |
| 8 (CREC Pref) | 21 23 23A 24 24A 24C 26 | 34.3 |
| 9 (NSP Alt) | 21 23 24 24B 27 | 33.1 |
| 10 | 21 23 23A 24 24B 27 | 34.0 |
| 11 | 21 23 24 24A 24B 27 | 34.0 |
| 12 | 21 23 23A 24 24A 24B 27 | 34.3 |

**Network 4**

| Route | Nodes | Length |
|---|---|---|
| 1 (NSP Pref) (DNR Pref) | 26 28 30 30A 34 35 | 30 |
| 2 | 26 27 29 31 31A 33 34 35 | 34.5 |
| 3 | 26 27 29 31 31B 34 35 | 34.5 |
| 4 (CREC Pref) | 26 27 29 31 31A 30A 34 35 | 34.5 |
| 5 (NSP Alt) | 27 28 30 30A 34 35 | 28.6 |
| 6 | 27 29 31 31A 33 34 35 | 32.7 |
| 7 | 27 29 31 31B 34 35 | 32.7 |
| 8 | 27 29 31 31A 30A 34 35 | 32.7 |

3. Network 3 offers twelve routing alternatives between Nodes 21 and 27 (Table 8.11). Impacts to forestry, human settlements, and agriculture preclude paralleling an existing 230-kV line here and in Network 4 (Table 8.7). The impacts of construction activities on the bog and access to the corridor are important considerations in Network 3.

4. Network 4 connects Nodes 27-35 (as amended earlier), and has eight routing alternatives (Table 8.11). Potential impacts to human settlements, agriculture, and forestry are of major importance in the area. Right-of-way sharing in this network was vetoed by the committee due to adverse agricultural impacts (Table 8.10).

While the staff in general sees a benefit to paralleling the existing 230-kV line in Networks 3 and 4, the heavy involvement of local planning commissions, interested citizens, and the decisions made at the local level by the EQB preclude any disagreement with the route selection process. The staff finds the route selection process competent in all respects, and finds the route as amended to be the best of the chosen alternatives.

## 8.8 CONCLUSION

A transmission intertie with Canada appears to be the best alternative from both an economic and environmental viewpoint. The particular line selected appears to be the best alternative for the intertie.


References for Section 8

1. "Final Environmental Impact Statement EQC Docket No. NSP-TR-1," November 22, 1976. The Environmental Quality Council. Addendum to the Draft Environmental Impact Statement for the proposed Northern States Power high-voltage transmission line Forbes-International Border Project.

2. Report of the Route Evaluation Committee, NSP-TR-1 to the Minnesota Environmental Quality Council, November 1976.

3. "Findings of Fact, Construction Permit, and Map showing Designated Route, for the Northern States Power Company 500 kV High Voltage Transmission Line Forbes to the International Border," Minnesota Environmental Quality Council, 1977.

4. "Findings of Fact and Conclusions of the Minnesota Environmental Quality Board, July 19, 1977, and Notice of Minor Route Alteration," Minn. Env. Qual. Bd., 550 Cedar St., Room 100, St. Paul, Minn. 55101.

5. Resolution passed by the Minnesota Environmental Quality Board, July 19, 1977.

6. Draft EIS, Chapter 6, Minnesota Environmental Quality Council, November 1976.

# 9. PERMITS AND COMPLIANCE WITH OTHER REGULATIONS AND CODES

## 9.1 GOVERNMENTAL PERMITS REQUIRED

### 9.1.1 Federal

A Presidential permit to construct, operate, maintain and connect facilities for the transmission of electrical energy at the boundary between the United States and Canada is required according to Executive Order No. 10485, Part 32 Section (A) (3) of the regulations of the U.S. Department of Energy (DOE).

An order must be secured from the Economic Regulatory Administration (ERA) of DOE pursuant to Section 202 (e) of Part II of the Federal Power Act (49 stat. 849, 16 U.S.C. 824a (e)) for the transmission of electrical energy from the United States to a foreign country. Consequently ERA is required by law (National Environmental Policy Act) to prepare an environmental impact statement for the project.

A 404 permit from the U.S. Army Corps of Engineers is required for construction activities at river and stream crossings and in wetlands. A Section 10 river-crossing permit will also be required from the Corps for all river and stream crossings along the proposed route.

A permit must also be obtained from the Department of the Interior for that portion of the proposed NSP route that crosses Federal lands, in this case LUP lands. The Federal Aviation Administration must be notified of the proposed construction in order to determine whether any hazards to aircraft are created.

### 9.1.2 State

The State of Minnesota, pursuant to the Minnesota Energy Agency law, must grant a Certificate of Need for any transmission line over 100 miles long and over 200 kV.

The Minnesota Environmental Quality Council also has jurisdiction over the location of all lines of 200 kV or more. After hearings and studies of all the proposed corridors and routes within them, the EQC grants a construction permit to NSP for a specific route.

In addition, the State Department of Aeronautics has jurisdictional and review responsibilities, similar to those of the FAA, to determine whether any hazards to aircraft will occur. An information notice on the routing of the proposed line will be filed with the State Department of Aeronautics for evaluation and approval.

Permits to cross state and Federal highways must be obtained from the Minnesota Highway Department.

Written permission by Minnesota Department of Natural Resources is required for some stream crossings, particularly if any culverts are to be installed for stream crossing. Stream crossings under the jurisdiction of the Minnesota DNR are limited to the 1 km-wide corridor along the proposed route.

A permit must be obtained from the Minnesota DNR to erect transmission lines across any state-owned lands.

# 10. MEETINGS HELD AND CONTACTS MADE FOR OBTAINING INFORMATION UTILIZED IN PREPARING THE ENVIRONMENTAL IMPACT STATEMENT

## 10.1 MEETINGS

The following contacts were made by the staff to obtain information for preparation of the draft environmental impact statement.

1. Site visit with specialists from the Northern States Power Company.
2. State Demographer, State Planning Agency, St. Paul, Minnesota.
3. Environmental Quality Council, State Planning Agency, St. Paul, Minnesota.
4. Land Management Information Center, State Planning Agency, St. Paul, Minnesota.
5. Staff members in College of Forestry, University of Minnesota, St. Paul, Minnesota.
6. Staff members of the Department of Soil Science, University of Minnesota, St. Paul, Minnesota.
7. Department of Biology, University of Minnesota, St. Paul, Minnesota.
8. University of Minnesota, Center for Urban and Regional Affairs, State Planning Agency, St. Paul, Minnesota.
9. Minnesota Department of Natural Resources, Division of Waters, Soils and Minerals, St. Paul, Minnesota.
10. Minnesota Department of Administration, Division of Public Actions and General Services, St. Paul, Minnesota.
11. Agricultural Experiment Station, University of Minnesota, St. Paul, Minnesota.
12. Minnesota Department of Natural Resources, Bureau of Environmental Planning and Protection, St. Paul, Minnesota.
13. Minnesota Historical Society, St. Paul, Minnesota.
14. Terra Archeological Services, Minneapolis, Minnesota.

## 10.2 TELEPHONE CONTACTS

The following organizations were contacted by telephone to obtain information needed in preparing the draft environmental impact statement.

1. WCCO-TV, Minneapolis, Minnesota.
2. Freshwater Biological Research Foundation, Minneapolis, Minnesota.
3. Illinois Water Survey, Urbana, Illinois.
4. Department of Soil Science, University of Minnesota, St. Paul, Minnesota.
5. National Climatic Center, Asheville, North Carolina.
6. Minnesota Pollution Control Agency, Minneapolis, Minnesota.
7. Environmental Protection Agency, Chicago, Illinois.

8. International Falls Weather Bureau, International Falls, Minnesota.

9. County Planner, Lake of the Woods County, Baudette, Minnesota.

10. Zoning Administrator, Koochiching County, International Falls, Minnesota.

11. Headwaters Regional Development Commission, Bemidji, Minnesota.

12. Arrowhead Regional Development Commission, Duluth, Minnesota.

13. Director of Planning and Zoning for St. Louis County, Duluth, Minnesota.

14. Minnesota Department of Economic Development, Minneapolis, Minnesota.

15. Minnesota Department of Natural Resources, Wildlife and Parks and Recreation Divisions, St. Paul, Minnesota.

16. Minnesota Department of Agriculture, St. Paul, Minnesota.

17. Minnesota Department of Employment Services, St. Paul, Minnesota.

18. Midwest Research Institute, Minnetonka, Minnesota.

19. Northwest Regional Development Commission, Crookston, Minnesota.

20. County Extension Office, Roseau, Minnesota.

# APPENDIX A. COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

Reserved for comments and responses.

# APPENDIX B. SUMMARY OF MANITOBA HYDRO ENVIRONMENTAL ASSESSMENT--500-kV TRANSMISSION LINE RIGHT-OF-WAY DORSEY-RIEL-INTERNATIONAL BORDER

## B.1 INTRODUCTION

Manitoba Hydro has made application to the National Energy Board of Canada for permission to construct and operate a 500-kV transmission line extending from the Dorsey Substation northwest of Winnipeg to the international border in the vicinity of Sprague, Manitoba. Here the line will traverse the border and connect with the 500-kV line proposed by the Northern States Power Company in Minnesota. Major reasons for the establishment of the project are differences in the type of generating facilities and seasonal capabilities of the two utilities. Manitoba Hydro is predominantly a hydroelectric system with operations planned to meet peak electrical demands that occur during the winter months. Northern States Power has generation capacity comprised primarily of coal-fired and nuclear power plants that provide peak demand during the summer months. During the summer, Manitoba Hydro will generally be in a position to sell surplus electrical energy to Northern States Power and thus gain revenue for the Province of Manitoba. In winter, particularly during periods of low streamflows, Northern States Power will reciprocate by selling electrical energy to Manitoba Hydro. The overall objectives of the proposed project are to provide: (a) a means for seasonal exchange of electrical power which will allow for the deferment of costly capital spending for new generation in both the Manitoba Hydro and Northern States Power service areas (b) the availability of electrical energy during low flow conditions in Manitoba rivers, and (c) increased stability during periods of system disturbance and a source of emergency power in the event of generation outages.[1] The Manitoba Hydro portion of the overall project has been approved by the National Energy Board of Canada.

## B.2 NEED FOR AN ENVIRONMENTAL STUDY

As part of the planning process, Manitoba Hydro developed a comprehensive environmental assessment and report for the proposed line. This report was submitted to the National Energy Board on January 6, 1977. The environmental assessment report was prepared to satisfy the environmental guidelines set forth by the National Energy Board in July, 1974. Within the province of Manitoba two environmental review processes are necessary for approval of the proposed transmission system. The first process came into effect in November 1975 and is a Cabinet-approved policy known as the Manitoba Environmental Assessment and Review Process.[1] The second process became effective as of January 1976 with the passing of the Planning Act and the establishment of the Cabinet-level Provincial Land Use Committee and its Interdepartmental Planning Board. The Provincial Land Use Committee was the provincial body giving final approval on the line routing as developed in the environmental study. Approval was granted on December 7, 1976.

## B.3 ENVIRONMENTAL ASSESSMENT PROGRAM

Manitoba Hydro undertook a comprehensive program to involve appropriate government agencies and special interest groups in the planning process. The objectives of the program were:

1. To convey to provincial agencies, municipal councils, and special interest groups, information relevant to the project including the possible effects of transmission line construction and operation on the local environment;

2. To obtain additional and often unpublished information concerning the physical, biological and cultural environments which might assist in or be affected by the siting of a transmission line;

3. To achieve a general consensus on resource-use priorities; and

4. To seek formal approval of the environmental assessment process and the preferred right-of-way location.

Formal reviews and presentations to various government agencies and special interest groups occurred at the following major decision-making points: definition of the study area, delineation of "macro-corridors," review of alternative routes, and selection of the preferred right-of-way.

B.3.1 Study Area

Study boundaries were determined on the basis of various technical and environmental considerations. Technical considerations were relative to the origin of the line at the Dorsey Substation, northwest of Winnipeg; the objective of developing a 500-kV transmission loop around Winnipeg; the location of a major new transformer station at Riel, southeast of Winnipeg; the desire to have a multiline corridor east of Riel; and the generally southeasterly direction the line would extend to connect with the Northern States Power line at the international boundary. Environmental parameters considered were the high quality agricultural land southeast of Winnipeg, present and future land-use patterns near Winnipeg, and the extensive ecologically sensitive bogs located east of the Marcland Ridge.

The study area was divided into urban and rural sections or areas prior to the initiation of the environmental assessment. Differences in environmental and technical parameters were noted for the two areas. A review of existing data coupled with information from reviews by Provincial Government departments and interpretation of the National Energy Board Environmental Guidelines provided a basis for the identification of environmental concerns, also referred to as "factors" (Table B.1).[1]

Table B.1. Primary Environmental Factors Utilized in Route Selection and Impact Analysis in the Urban and Rural Study Areas

| Rural Area | Urban Area |
|---|---|
| Agriculture | Agriculture |
| Natural environment | Natural environment |
| Cultural features | Urban planning program |
| Visual impact | Cultural features |
| Land resources | Visual impact |

B.3.2 Selection of the Preferred and Alternative Rights-of-Way

As data collection and mapping progressed, an evaluation system consisting of "factor rules" was developed.[1] These rules were established to create an objective and consistent impact rating scale reflecting relative levels of sensitivity designated as low, moderate, high, severe, and prohibitive. A low impact rating was given to areas expected to be least impacted by the proposed project. Conversely a prohibitive rating was assigned to areas subject to greatest disruption. Information portrayed on individual maps depicting impact rankings for each factor (Table B.1) was subsequently transposed to produce a "Composite Impact Map". The Composite Impact Map thus indicates areas where combined impacts range from low to prohibitive. Areas on the composite map having the highest relative impact ratings were avoided in routing the transmission line and were subsequently referred to as regional avoidance areas. Between the regional avoidance areas, lower impact zones (macro-corridors) were identified and considered suitable for the routing of a transmission line.

Within each macro-corridor, alternative rights-of-way were designated for further examination. Special studies and investigations in forestry, biology, archeology, visual esthetics, agriculture, land-use, and electrical effects of operating 500-kV lines were undertaken to evaluate the alternative rights-of-way. These studies also provided baseline information for evaluating local and site-specific environmental impacts which might potentially result from the construction and operation of a 500-kV transmission line. In addition to environmental data, technical and public policy concerns were employed to reduce the number of alternative rights-of-way for detailed impact assessment.

Each alternative route was evaluated on the basis of anticipated impacts in order to determine the preferred right-of-way. In situations where impacts were unavoidable, the involvement of governmental agencies and public interest groups played a critical role in identifying the significance of impacts and resource trade-offs so that the most important impacts could be avoided.

The preferred right-of-way traverses intensively used agricultural land near Winnipeg and crosses the Red River in an area undergoing rapid urbanization (Fig. B.1). Most of the route around Winnipeg parallels existing rights-of-way. Eastward from the Riel Substation, in the rural municipality of Springfield, the transmission line will constitute the first line in a corridor in which three more lines will ultimately be constructed. The line will extend east from the Riel Substation for approximately 20 miles, then southeasterly to cross the Marcland Ridge and the international boundary southeast of the town of Sprague (Fig. B.2).

## B.4 IMPACTS OF CONSTRUCTION AND OPERATION OF THE PREFERRED RIGHT-OF-WAY

It was not possible to route the line so as to avoid all crossings of agricultural land in either the urban or rural portions of the study area. Existing transmission line rights-of-way and the Red River Floodplain were used wherever possible to minimize impact on agricultural activity. Wherever practicable, attempts were made to follow the half-mile lines and "roal allowances" to minimize impact.[1] Construction of the 500-kV line in the urban study area will take approximately 4.75 acres (1.9 ha) of agricultural land out of production. Approximately 3 acres (1.2 ha) of agricultural land will be lost from production in the rural study area. In both cases these losses are due mainly to tower and guy wire placement.

Impacts of the transmission line on natural environments of the urban areas are expected to be minimal since most sensitive areas were avoided during route selection. Wildlife diversity in certain areas is expected to increase as a result of natural revegetation along cleared rights-of-way. Some erosion and temporary impacts to aquatic biota may occur during tower erection and conductor stringing operations.

The transmission line is routed to minimize disruption to residences, parks, cemeteries and other cultural features with few exceptions. A number of residences will be affected by the transmission line east of the Riel Substation in the vicinity of Springfield. After consultation with Springfield officials, it was resolved that routing the line adjacent to a road right-of-way and impacting existing residences was more desirable than creating a multiline corridor removed from the road right-of-way. The line will parallel an existing right-of-way through Highland Park. Here selective cutting and a planting program will be employed to minimize visual impacts.

Visual impacts are likely to be high along much of the route, since the landscape is open and flat, Attempts were made to reduce visual impacts by routing the line in areas removed from heavily travelled highways. Visual impacts will be reduced at highway crossings by selective cutting and/or planting programs following construction. No buffer zones will be left or created in agricultural areas, thus avoiding interference with normal agricultural operations.

A more detailed treatment of impacts associated with the project is included in a document entitled, "Environmental Assessment Study. Manitoba Hydro 500 kV Electric Power Transmission Right-of-Way Dorsey-Riel-International Border Winnipeg-Minneapolis Interconnection;" prepared by Manitoba Hydro and James F. MacLaren Limited, December 1976.

## B.5 PROCEDURE FOR CERTIFICATION

Manitoba Hydro submitted an environmental assessment report to the National Energy Board in January 1977. A formal hearing was held on May 10, 1977, in Winnipeg to hear arguments relating to economics and public interest concerning the energy exchange, and on arguments relating to location of the line.

The findings of the hearing were published by the National Energy Board in July 1977. The title of the Report is:

> National Energy Board
> Reasons for Decision
> In the Matter of the Application Under
> the National Energy Board Act of
> The Manitoba Hydro-Electric Board

Licenses EL-97, 98, 99, 100, 101, 102, and 103 were granted for the transactions of the total American energy exchange, including that of the Agreement with Northern States Power, to be made operative in 1980. The line was approved by Certification of Public Convenience and Necessity EC-III-16 of the National Energy Board.

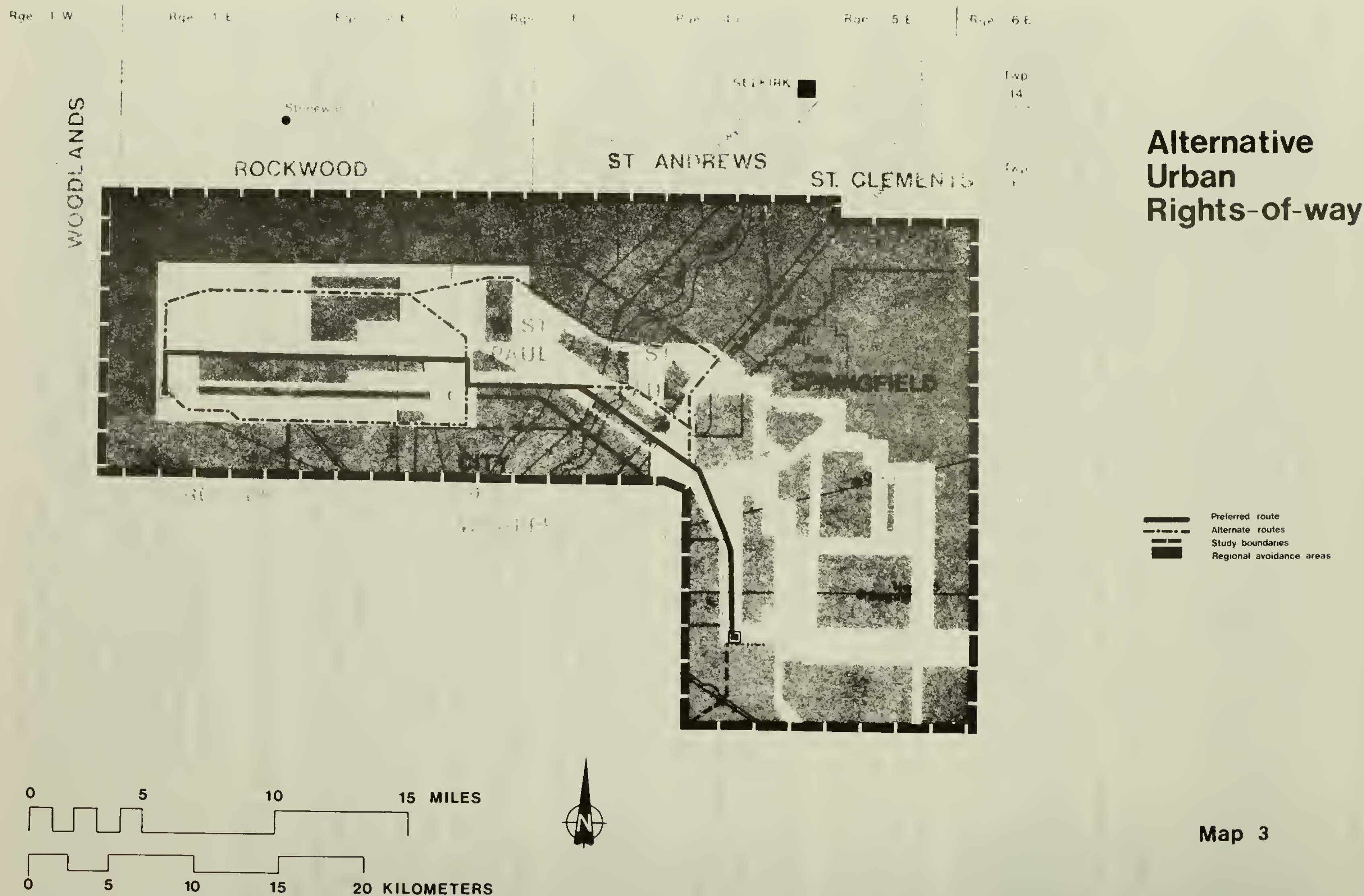


Fig. B.1. Alternative Urban Rights-of-Way. Modified from "Summary. Manitoba Hydro Environmental Assessment." Manitoba Hydro and James F. MacLaren, Ltd., Map 3, Mar. 1977.

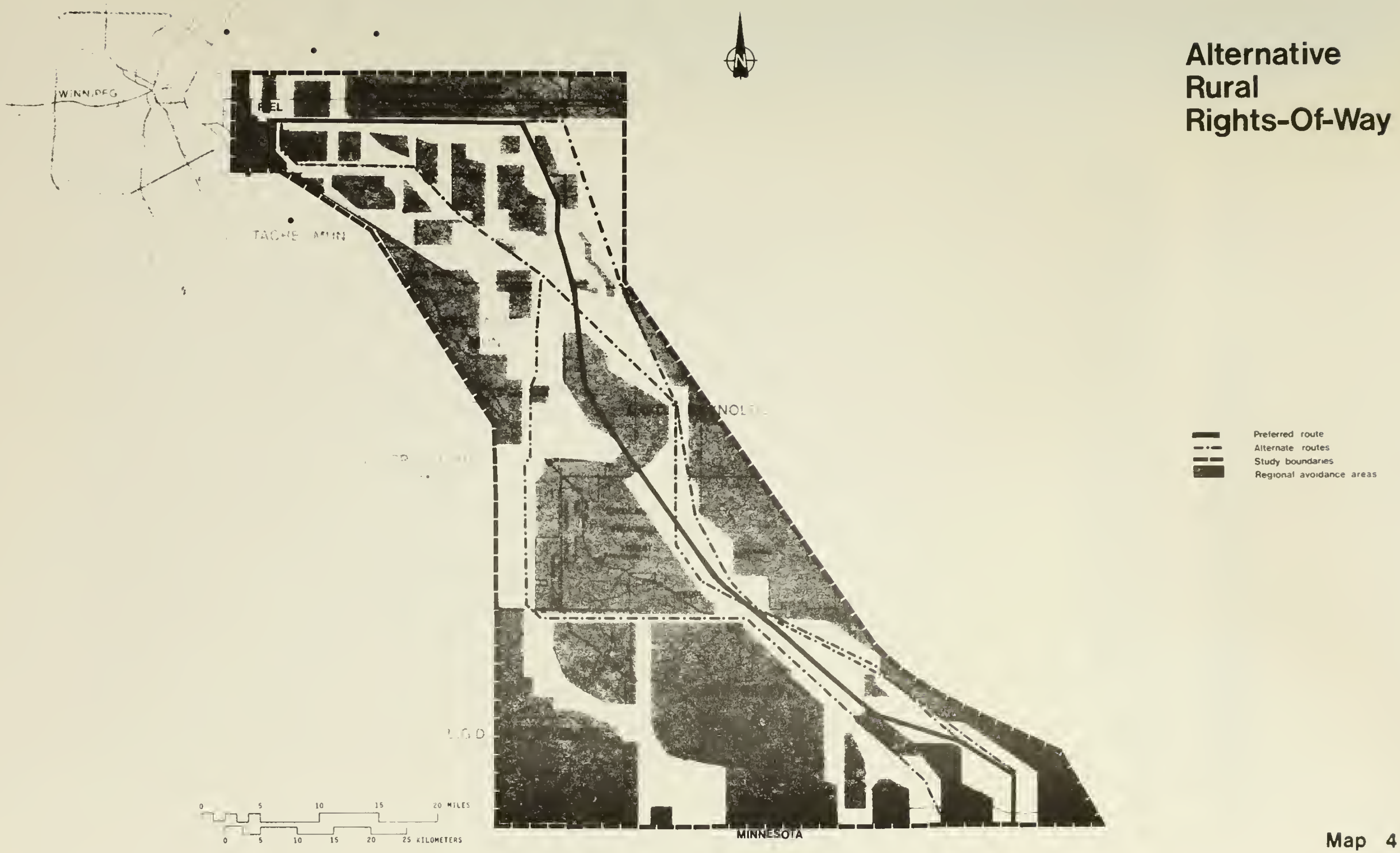


Fig. B.2. Alternative Rural Rights-of-Way. Modified from "Summary. Manitoba Hydro Environmental Assessment." Manitoba Hydro and James F. MacLaren, Ltd., Map 4, Mar. 1977.

Reference for Appendix B.

1. "Summary, Manitoba Hydro Environmental Assessment Study." Manitoba Hydro and James F. MacLaren Limited, Winnipeg, Manitoba. March 1977.

# APPENDIX C. RESULTS OF THE U. S. FISH AND WILDLIFE SERVICE "THRESHOLD EXAMINATION"

CONCERNING IMPACTS WHICH MAY OCCUR TO THE GRAY WOLF, BALD EAGLE, AND PEREGRINE FALCON

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

IN REPLY REFER TO:
AFA-SE

JUN 23 1978

Mr. James M. Brown, Jr.
Division of Power, Supply
and Reliability
U. S. Department of Energy
Washington, D.C. 20461

Dear Mr. Brown:

This letter is in regard to the formal consultation requested by your agency for the proposed construction of a 500 Kv transmission line by Northern States Power Company across northern Minnesota. The line segment addressed in this letter is the Forbes to Warroad portion of the overall project which extends from Winnipeg, Manitoba to the Twin Cities.

This line segment lies in an area known to be inhabited by gray wolves, bald eagles and is included in a broad range for the peregrine falcon. Furthermore, roughly one half of this line segment transects an area designated as critical habitat for the gray wolf. Critical habitat is encountered on the south where the line will cross state highway 1 near Togo and leaves critical habitat in the northwest just east of Faunce.

On June 8 an aerial on-site inspection of the proposed project was conducted. This was supplemented the following day by a meeting to discuss environmental aspects of this project. The on-site inspection was attended by Keith Wietecki, NSP; Dave Langowski, John Winship and Dick Uptegraft, U. S. Fish and Wildlife Service.

The Environmental Report - 500 Kv AC Single Circuit Forbes to International Boundary Transmission Project, dated April 1, 1977 and Draft Environmental Impact Statement, NSP TR-1 provide in part the following evaluative information:

"The width of the right-of-way to be cleared for the project will vary with the line voltage and the opportunities for right-of-way sharing. On the 500 kv line where a 200-foot right-of-way is required, 180 feet will be cleared. Where the line parallels the existing 230 kv line a 160-foot right-of-way and 150-foot clearing are required.

"In general, the right-of-way will be clear-cut to the widths mentioned above. Tall or dangerous trees outside the cleared right-of-way which present a potential hazard to the line will also be removed.

"Where the right-of-way goes through areas of low-growing brush, muskeg swamps or black spruce bogs, the right-of-way clearing will normally be reduced in widths to approximately the center one-third."

Both publications further address wildlife management practices which will be undertaken by NSP. The wildlife management plan was developed in cooperation with the Minnesota Department of Natural Resources, Fish and Wildlife Division, and is replicated within the Draft Environmental Impact Statement:

"NSP's right-of-way management program is developed around the principal of 'habitat diversity' and 'type interspersion,' with the objective of maximizing those types of plant communities most favorable to wildlife.

"In an attempt to develop habitat diversity and to meet the multiple needs of the various wildlife species in our area, the central one-third area of the right-of-way will generally be maintained in a grassy-herbaceous type of cover. The outer two-thirds of the right-of-way on both sides of the grassy-herbaceous cover will be managed to encourage the development of a variety of herbs, shrubs and low-growing trees which have potential value as wildlife food and/or cover. In selected areas on upland sites, consideration will also be given to the planting of fruit-bearing shrubs and small trees such as hawthorn, mountain ash and other fruit-producing shrubs, in an effort to improve existing habitat conditions. Also in areas where it is desirable to maintain alder communities for woodcock habitat, cutting to rejuvenate the alder will be accomplished at intervals of 15 to 20 years.

"In areas where the right-of-way falls near known or potential winter deer yarding areas, a greater portion than the central one-third area of the right-of-way will be maintained in the grassy-herbaceous stage of succession in order to maximize the quantity of grasses, sedges and other herbaceous foods for early spring grazing. Areas of the right-of-way that pass in closer proximity to deer yards will be maintained entirely in shrubs and other young tree shoots in order to maximize the quantity of winter browse food."

These management practices are designed to "break-up" monotypic vegetational types as found over the course of this proposed project. This in turn will enhance conditions for deer and other species which thrive on more diverse habitat types. By increasing prey species the net effect upon gray wolves will be positive thus improving critical habitat.

In discussing areas proposed for critical habitat in the wolf recovery plan the recovery team stated: "To describe all of the land within these sanctuary areas as essential habitat would be unrealistic. The wolf is a wide ranging animal and is reasonably adaptable. As long as its food supply is assured and as long as man will let the animal live, it is unreasonable to try to define or describe habitat that is essential to its survival. Of far greater importance is the way land is managed for the wolf's prey."

Furthermore, information as to location of eagle nests had been obtained by NSP from biologists with the Minnesota Department of Natural Resources to avoid potential impact upon this species. Peregrine falcons are not known to inhabit the area proposed to be altered by this transmission line.

It is my biological opinion that with the implementation of the management practices proposed by Northern States Power in their Environmental Report and Draft Environmental Impact Statement and information derived from these documents, threshold examination and subsequent meeting that this project will not jeopardize the continued existence of the gray wolf, peregrine falcon and the bald eagle nor will it result in the destruction or adverse modification of designated critical habitat for the gray wolf. Critical habitat has not been designated for the peregrine falcon or bald eagle.

NSP has submitted a formal application to construct the transmission line as described above. However, this discussion does not address or approve the right of way request which is presently being considered.

If you require additional information, please contact the Office of Endangered Species at 612-725-3596.

Sincerely yours,

Charles A. Hughlett

Charles A. Hughlett
Acting Regional Director

cc: Carrol Henderson
SE Coord, MN DNR
Keith Wietecki, NSP